# Mining CONGRESS JOURNAL

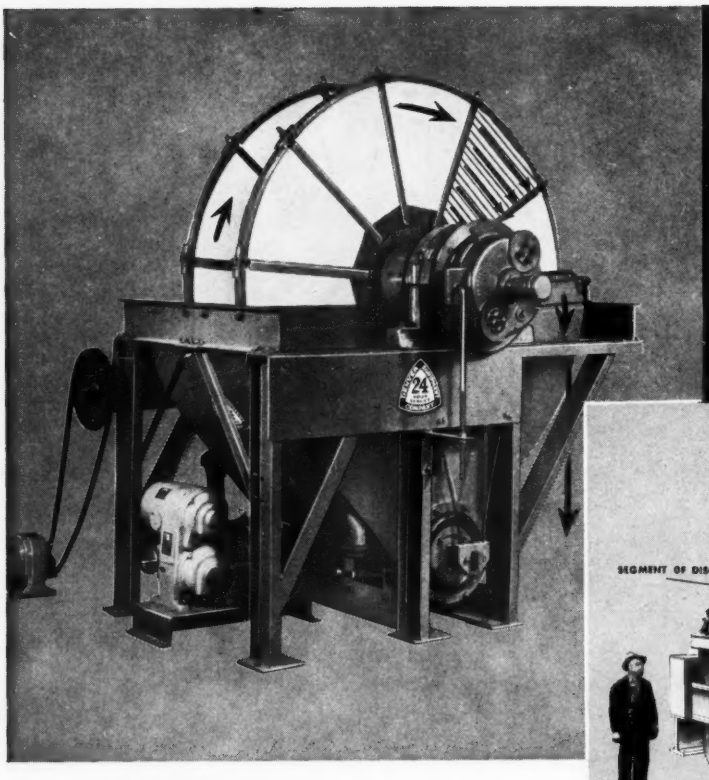
AUGUST 1957

*PREVUE ISSUE*

**AMC**
**Metal Mining**
**and**
**dustrial Minerals**
**Convention**

*Salt Lake City*
*ptember 9-12, 1957*

**See pages 51-63**



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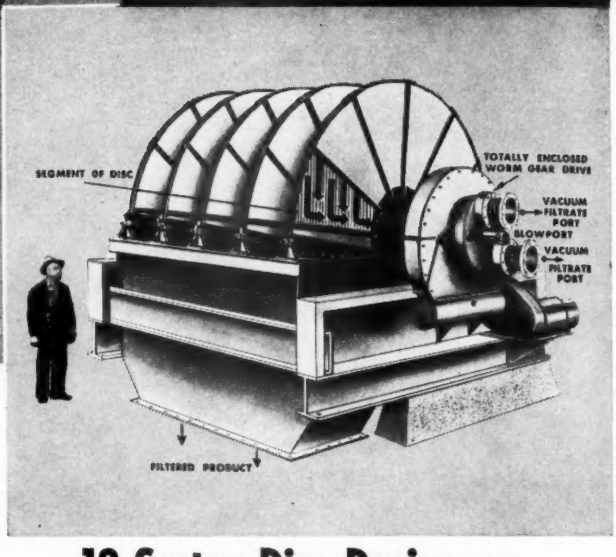
NEW!




## DENVER Agitator-Type DISC FILTER

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...offers increased filtration capacity and reduced moisture content—PLUS a simple agitation mechanism. NO PACKING GLANDS to cause expense and delays. Proper tank agitation is supplied to keep solids in suspension for even cake distribution of filter sectors.

NEW, patented DENVER agitation mechanism eliminates need for submerged bearings, packing glands or sealing water. Contamination from grease or sealing water is completely eliminated. Maintenance is minimum. Agitating mechanism can be removed easily as unit. Write for bulletin F9-B5.

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Patented gravity drainage grooves in filter sector remove residual moisture by gravity and prevent blow-back of moisture before cake discharge giving drier product. Available with Patented Tank Agitator.

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# Mining CONGRESS JOURNAL

AUGUST, 1957

VOLUME 43 NUMBER 8


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**Opinions expressed by authors within these pages are their own and do not necessarily represent those of the American Mining Congress**

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# push your coal production UP

# with this hard-working JEFFREY team

### Jeffrey 70-UR Universal Cutter for bottom, top and shear cuts

Head and cutter can be rotated 360° in either direction and positioned to make any kind of cut, any place in the seam. From one location, the 70-UR Cutter makes a 30-foot horizontal cut (using a 9-foot cutter bar) or a shearing cut 5'5" to either side of the machine's centerline. No wonder mine superintendents brag about its tonnage-producing ability!

**Operators** report smooth and positive traction for sumping, even when cutting at extreme range. The 70-UR's wide wheel gauge, long wheel base, low center of gravity and large pneumatic tires give sure-footed stability. Maintenance men say that its rugged construction reduces downtime and cuts upkeep costs.

## Jeffrey 81-A Loader for high capacity loading

From both a production and a maintenance standpoint, the 81-A Loader is a superior machine. It is well balanced and flexible, and is easily maneuvered; trams at 137 FPM and can be turned in its own length. The conveyor swings 45° either side of center and elevates properly to load shuttle cars on the straight and in break-throughs. It has a rated capacity of 8 TPM and a maximum capacity of 10 TPM.

Maintenance is simplified on the Jeffrey 81-A Loader because every motor and gear case is a separate, detachable unit. This kind of unit construction is used throughout, resulting in rapid replacements and lower upkeep costs.

## Jeffrey 56-FHR Face Drill for shot hole drilling

This single-boom drill provides a high degree of operating flexibility. It is rubber-tire-mounted and self-propelled by two hydraulic motors. Another operates the cable reel. The drilling head can be swung by finger-tip control to any desired position for shot hole placement. Drilling range is 7′ 2⅝″ vertically and 13′ 1¾″ horizontally.

## Jeffrey 56-RDR Roof Drill

Big, sturdy, easy to maneuver and fast drilling. 10′ 9½″ arm swing permits a wide room to be bolted from one position. Hydraulic torque wrench assures accurate bolt tightening.

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# Let's talk Wobbler*

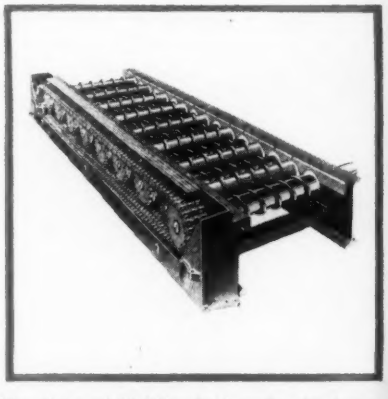
*At the American Mining Congress Convention*

## Let's get together and figure out what the Universal Wobbler Feeder can do for you

A little Wobbler talk with Universal's engineers could easily make this convention one of the most profitable you've ever attended. Since its introduction at the AMC convention in Los Angeles last fall, the Wobbler has gained wide acceptance in the field. Mining men who saw it at the Coal Show in Cleveland in May were also enthusiastic about the Wobbler.

The Wobbler is being used in many operations. A few are iron ore, bauxite, slag, limestone. We'll gladly give you names of companies now using the Wobbler in these applications when we talk to you.

*To get in touch with a Universal Engineer, simply call DA 8-8366, Newhouse Hotel, Salt Lake City, and ask for the Universal room.*



*The Universal Wobbler feeds and scalps in one operation. Won't clog in wet, sticky material.

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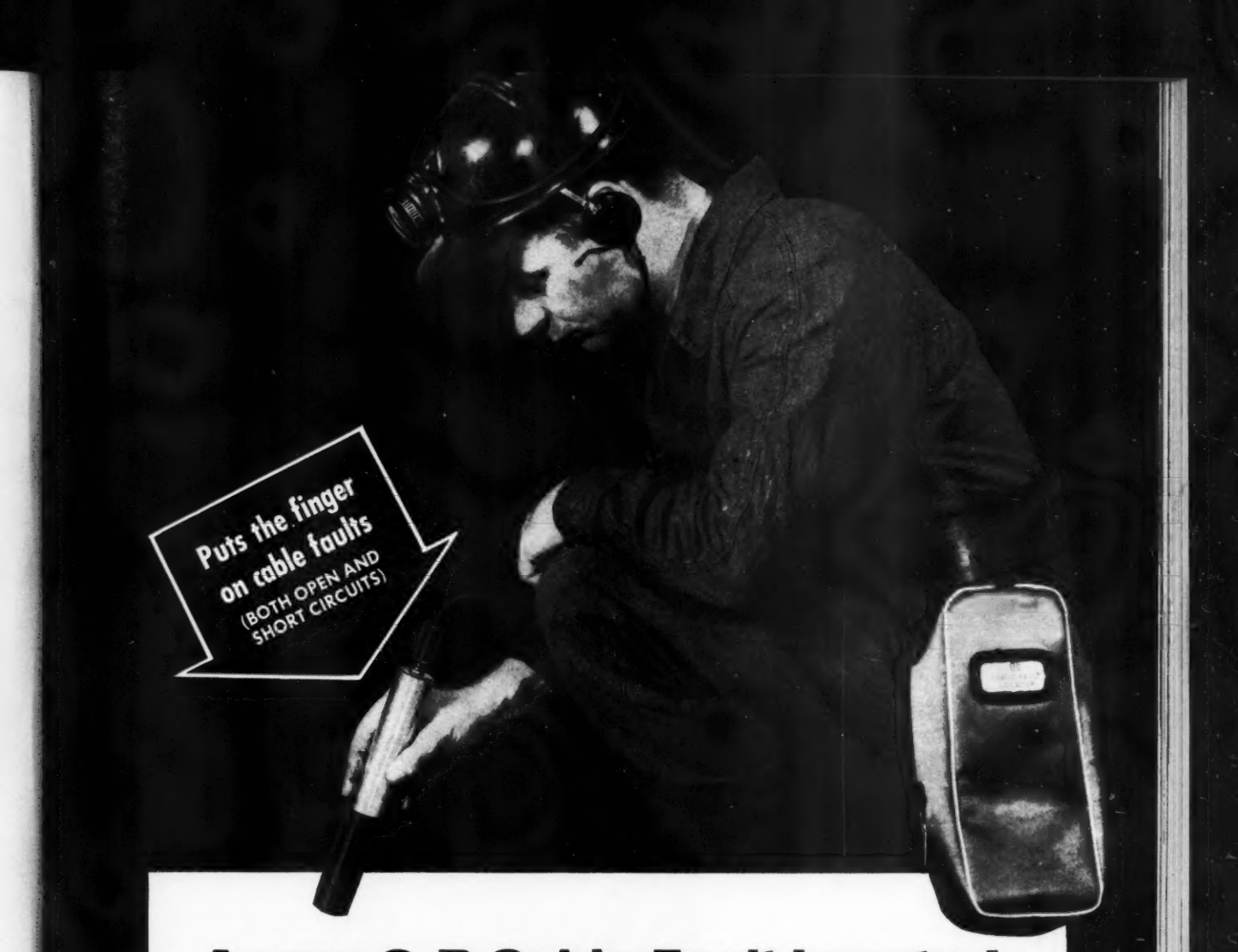


# A new O-B Cable Fault Locator!

**(in a light-weight, rugged, "pocket-size" package)**

Here's the simplest, lightest, most inexpensive, and easiest to use cable fault locator ever offered for mine service!

Designed to pinpoint both short and open circuits in trailing cables having two or more conductors — powerful enough to test cables up to 600 feet long! Complete "pocket-size" package consists of four small, extremely rugged elements which are shipped from the factory — and carried around the mine — in the handy canvas bag shown above.

To operate, simply connect battery and signal generator (about the size of a flashlight) to power end of cable and then move along cable with receiver and headphones as shown above.

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Write for more information now on the O-B Cable Fault Locator, Cat. No. 22567.

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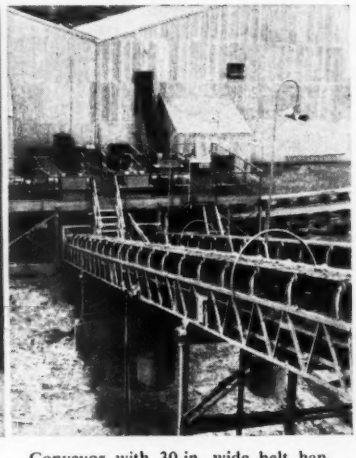
HERE's today's top answer to efficient, economical, long-life bulk handling — Link-Belt PRE-BILT sectional belt conveyors. They combine standard products, sectional truss frames and supporting bents to meet your exact requirements. Let a Link-Belt representative help you choose from 27 standard, packaged components — with drives up to 40 hp . . . 18, 24, 30 and 36-in. belt widths . . . 24 and 42-in. truss depths. For the full story, call your nearest Link-Belt office.

Inclines like this pose no special problems for highly-adaptable Link-Belt PRE-BILT sectional belt conveyors.



Conveyor with 30-in. wide belt handles iron ore concentrate and tailings from washing plant to loading hoppers.

Book 2579 outlines Link-Belt PRE-BILT sectional belt conveyor advantages. Write for your copy today.

**LINK-BELT**

**BELT CONVEYOR EQUIPMENT**

### FROM SELECTION TO OPERATION ... AS SIMPLE AS THIS

**EASY SELECTION.** Your Link-Belt representative will help you select the best combination of PRE-BILT sectional belt conveyor components.

**PROMPT QUOTATIONS.** He will prepare a comprehensive and accurate estimate of requirements for installations that permit "on-the-ground" survey.

**SIMPLIFIED PURCHASE.** Parts are standardized, interchangeable, all available from one supplier. Link-Belt representative can furnish all necessary data.

**QUICK DELIVERY.** PRE-BILT conveyors are built at nine strategic locations and are shipped from the plant nearest you.

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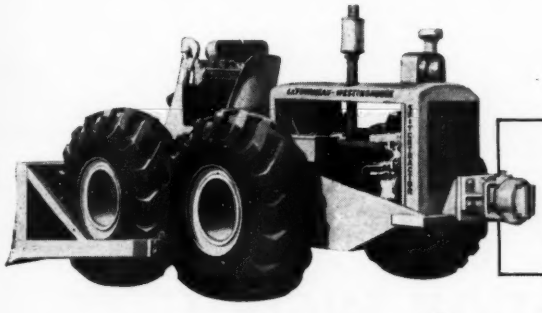
**NEW**
**double-duty**
**SwitchTractor**

Famous high-speed work-and-run tractor now available with standard railroad couplers. Railroad drawbar attachment now makes this famous high-speed tractor even more versatile, gives you the plus value of a go-anywhere off-track switcher for car-spotting work.



# SwitchTractor

## dozes, hauls, switches freight cars

Ten years hard use has improved and perfected the work-and-run Tournatractor. Thousands have proved their value in hauling, dozing, pushing, grading, scarifying, and compacting in practically every country in the world.

### Doubles value of Tournatractor

Now — with the new *SwitchTractor* application—this versatile unit gives you added utility. Equipped with standard railway coupler at the rear, SwitchTractor does double-duty, switches freight cars on your siding, in yard or pit. With wide 8'4½" tire gauge, rubber-tired switcher straddles tracks of all gauges.

SwitchTractor often eliminates the need for private switch engines and engineers, saves charges and delays of railroad switch service. Your single SwitchTractor and operator may well handle all your scattered tractor-dozer work — plus whatever freight switching is required.

### Off-track travel cuts switching time

Rolling on big, low-pressure rubber tires, 208 hp machine always takes the shortest route to the job. SwitchTractor can either push rail cars (with its dozer or push-plate), or pull with its coupler-equipped drawbar at rear. Tractor can start 18 empty or 5 loaded freight cars, move them up a 1% grade easily.

### 60% vs 30% coefficient of friction

Rolling on big rubber tires over ballast and ties, not on steel wheels over steel rails, SwitchTractor develops much more coefficient of friction (60% compared to 30%) than track locomotive of *twice* its weight. That means you have plenty of tractive power.

### Worthwhile savings with SwitchTractor

If you have to move freight cars in your operations, investigate this versatile new SwitchTractor. Get all the facts on how this coupler-equipped go-anywhere tractor can save money for you in equipment and manpower economies.

SwitchTractor—Trademark, Tournatractor—Trademark Reg. U.S. Pat. Off. ST-1075-M-b

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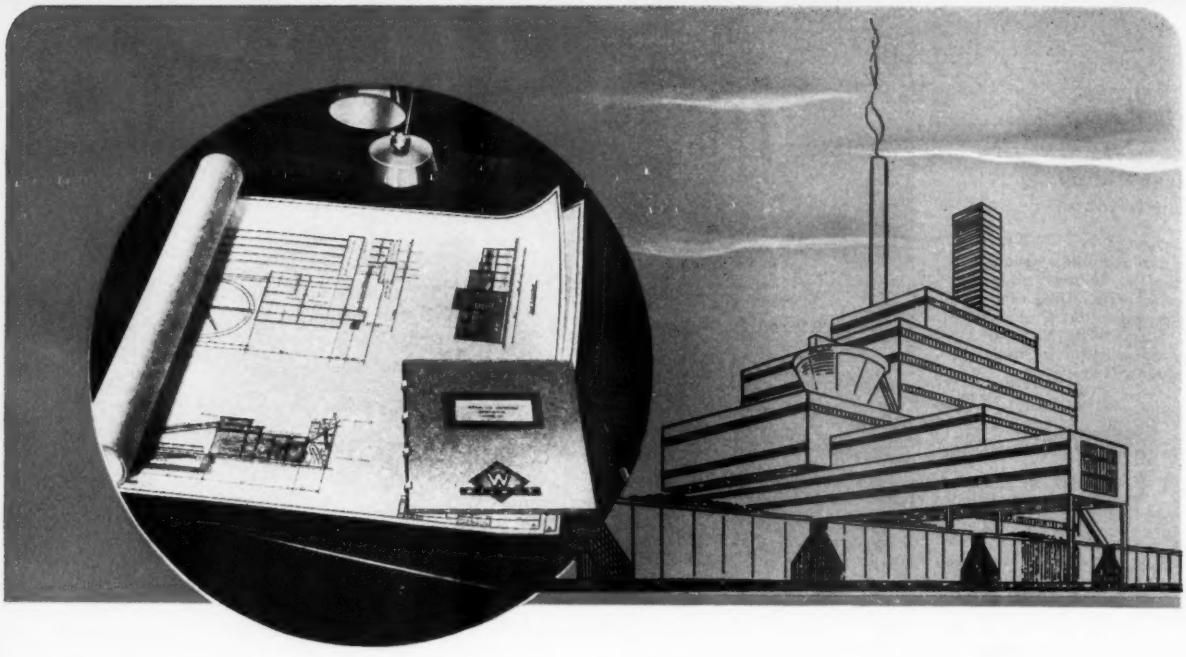
*A Subsidiary of Westinghouse Air Brake Company*

**Where quality is a habit**



*Behind Wilmot Proposal Drawings are*

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Since 1908 Wilmot Engineering Co. has been devoting itself exclusively to designing and building coal preparation plants and equipment. Wilmot was one of the first to apply automation to the dual problems of controlling labor costs and product quality. Today our recently enlarged development and research facilities combine with this wealth of engineering experience to assure you the most advanced plant and equipment.

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Our pilot plant houses Wilmot equipment for customer's testing and demonstration use.

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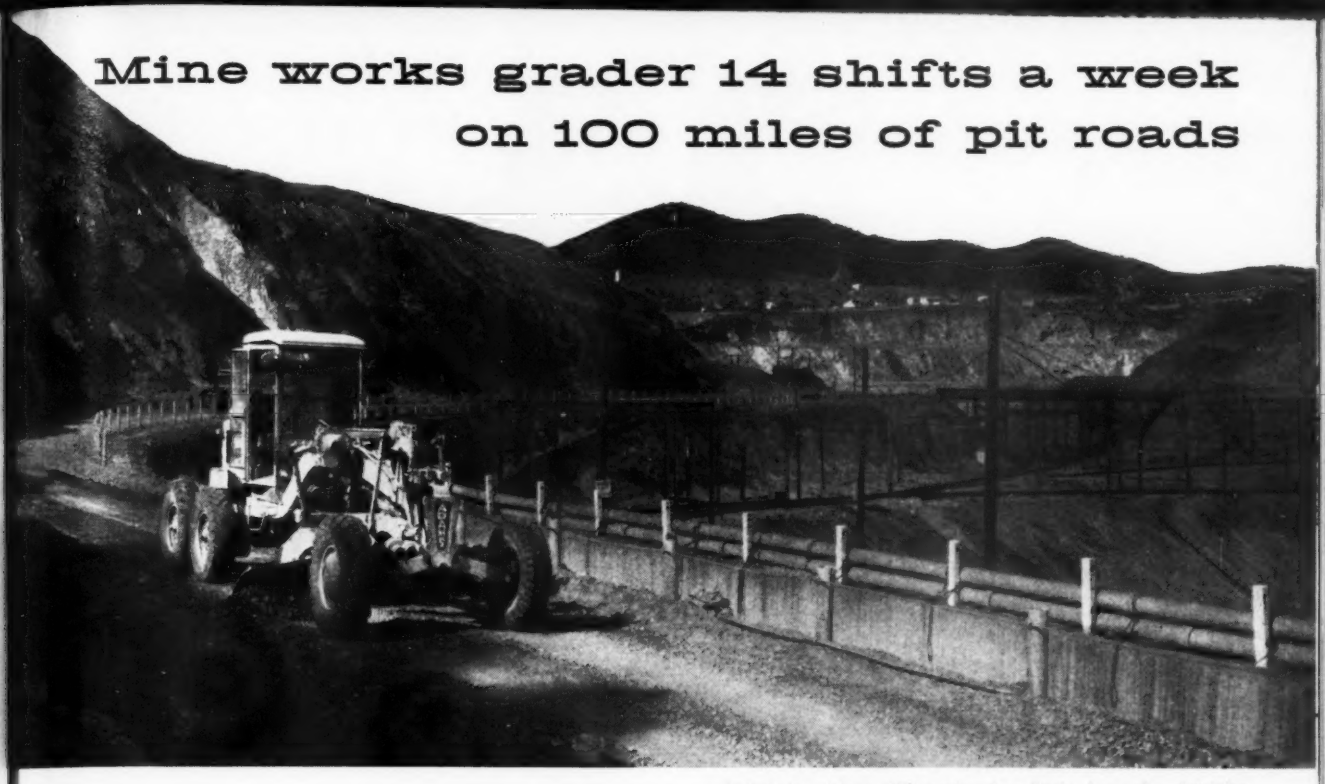
# Mine works grader 14 shifts a week on 100 miles of pit roads



Fast-moving Adams 550 grader does lion's share of maintaining more than 100 miles of bench roads at big copper mine. This 123 hp unit grades, ditches, backslopes, does scattered clean-up work.

Two shifts a day, 7 days a week is the rugged schedule of work for a 550 Adams* motor grader at a big southwestern copper mine. 4 to 6 operators take turns manning this heavy-duty unit as it hustles about . . . maintaining more than 100 miles of steep, winding mine roads.

### Adams handles many jobs

Roads at the mine coil around the huge open pit, along wide benches 15′ to 20′ high. Surfaced with crushed stone, roads vary in width from one to six lanes. Usually working in 2nd gear, the Adams 550 grades fast and accurately. It ditches, backslopes, does all-around work — such as filling ruts, leveling ridges, and cleaning up debris fallen from banks or spilled from haul units.

Tough assignments, long hours, are right down Adams' alley. Built to withstand severe stress and strain, these graders can take it!

Structurally, the "550" has a big, all-steel box frame for lasting strength and rigidity. It is continuous-welded to take stresses as a unit — from bolster plate to boxed-in rear end. Streamlined, front to rear, this Adams frame has no sharp bends, no cross-section welds, no bolted or riveted joints to break. Front axle is made of welded heavy bar and plate . . . with yokes, kingpins, and spindles of forged, heat-treated steel. This rugged frame foundation, outstanding in the industry, is a basic factor in Adams' accuracy of control, low power loss, and speed as well as its dependability and economy of performance.

Power-wise, the two engines from which you can choose have been job-proven in more heavy-duty construction and road maintenance use around the world, than any other engines available anywhere. Mechanically, all gears and shafts run on anti-friction bearings, and all clutches slide on ball bearings. The 8-speed transmission is the finest ever built for use in a motor grader.

### Adams lasts longer, works harder

Net result is a motor grader that lasts longer, works harder . . . with less upkeep. From the utility 220 model, with 60 hp . . . through 80, 115, 123, and 150 hp sizes . . . to the big torque-converter POWER-*Flow* 660, with 190 hp . . . Adams gives you more grader for your money.

Look into the Adams line of heavy-duty motor graders. Your LeTourneau-Westinghouse Distributor has all the facts and will be pleased to arrange a working demonstration of the model that fits your needs best.

Twisting uphill grading is done faster with Adams 550, because it offers *several* full-power speeds for each kind of work. With 15-speed transmission available, operator can always select gear that will get the most work done at the lowest cost. *Trademark G-1485-M-1

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*A Subsidiary of Westinghouse Air Brake Company*

**Where quality is a habit**

# BUILT TO TAKE A BEATING

## *ESCO* RUBBER CUSHION-MOUNTED HINGES

### ELIMINATE RIVET AND WELDING FAILURES ON DIPPER DOORS

The continuous pounding of extra-mean rock jobs is no problem for *ESCO* Dippers equipped with rubber cushion doors.

This new patented *ESCO* Rubber Cushion Mounted Wedge-Type Door can stand the high impact and shock of rough digging jobs. Wedge-type mounting eliminates troublesome rivets and objectionable excessive door weight. The hinges are cushioned along their entire length in oil-resistant rubber to absorb the shock that often causes hinge failure or other damage to ordinary welded or riveted dipper doors. Wedges replace rivets — locking the hinge to the door — providing full length cushioned hinge bearing. The Rubber Cushion Mounted Wedge-Type Door is available as standard equipment on a wide range of *ESCO* Dippers.

*ESCO* Dippers are built to out-dig any dipper made and to surpass all others—feature for feature.

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MFG. PLANTS AT PORTLAND, ORE. AND DANVILLE, ILL.
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# How self-powered scrapers help cut mine operating costs

Tournapulls may be self-loaded, push-loaded, or shovel-loaded. The 9-yard "D" shown here hauls at speeds to 29.5 mph, unloads in seconds, makes complete turn in 26 feet. Simple electric controls and big 4-wheel air brakes permit rig to work safely at high speeds in tightly restricted quarters.

**Read the following list of mine-scraper applications . . . analyze these scraper economies for your open pits:**

**1** In auxiliary stripping, where overburden is so thick that the wash or earth must be removed to allow boom-type equipment to work within its economical limits.

**2** Where spoil room for boom-tool operations is inadequate; where outcrop is bothered by property lines, highways, railroads, pipe lines, power lines and undivertable streams.

Rigs make 180° turns, in less than machine's length, operate in tight quarters as shown above. Tournapulls keep working in tough going when other self-powered scrapers bog down. When one wheel slips, exclusive power-transfer differential automatically transfers power to wheel on firmest footing. Positive geared steer on kingpin pivots prime-mover from side to side, "walking" drive wheels to fresh footing.

**3** Widening a bench at the side of the pit to provide greater casting area for shovel or dragline.

**4** Stripping wet top-layers of earth, which might slough and cause slides into a shovel cut.

**5** Cutting the initial box-cut, depositing the spoil out-of-the-way of later dragline operations.

**6** Stripping or mining small or isolated veins that do not warrant the expense of moving large excavating equipment to the site.

**7** Stripping hillside and hilltop operations...self-powered scrapers particularly adapted for this type of work.

**8** Cutting new beds for temporary or permanent stream diversions; building dams and settling ponds.

**9** Building grades for railroads and for truck haul-roads.

**10** Construction and maintenance of ditch and drainage systems.

**11** Grading around mine buildings and mine location housing.

**12** Land-fill disposal of refuse.

**13** Stockpiling of coal . . . spreads in even layers, compacts while hauling.

**14** Supplementary hauling of ore, coal, or overburden...open-top scraper can be shovel-loaded and used as a truck-type hauler.

**15** Mining lean ore, previously abandoned, in widely scattered or isolated areas.

**16** Stripping overburden where level piling of spoil is required.

**17** Stripping shallow overburden which does not justify expense of installing and operating major excavating equipment.

**18** Leveling spoil piles for drainage, reforestation, farming, etc.

**19** Removing and replacing top-soil for reclamation purposes.

If you have any of the above dirt-moving problems . . . write us or check with your nearest LeTourneau-Westinghouse Distributor. We'll be glad to have our experienced field engineers analyze your operation and propose suitable procedure and equipment for most economical handling. Our rubber-tired prime-mover scraper combinations are available in three sizes: "D" . . . 138 hp . . . 9 yards heaped capacity; "C" . . . 210 hp . . . 18 yards heaped capacity; BIG "B" . . . 293 hp . . . 27 yards heaped.

Tournapull—Trademark Reg. U.S. Pat. Off. P-1508-M-1

**LeTOURNEAU-WESTINGHOUSE COMPANY,** PEORIA, ILLINOIS

*A Subsidiary of Westinghouse Air Brake Company*

**Where quality is a habit**

# How to Install Bethlehem Roof Bolts

Illustrated here are four simple steps to take when installing Bethlehem Square-Head Roof Bolts. Regardless of the length and diameter of the bolts used, this procedure enables the job to proceed at a steady pace, and helps materially in minimizing installation costs.

Bethlehem Square-Head Roof Bolts are made in 5/8-in., 3/4-in., and 7/8-in. diameters, and are furnished in a wide range of lengths. We also manufacture a 1-in. slotted roof bolt, for use where a heavier bolt is required.

We recently issued an interesting 20-page illustrated catalog on roof bolting. If you would like to have a copy for reference, all you need do is drop a line to the nearest Bethlehem sales office.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
*Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

**1** Using regular drilling equipment, the hole is drilled to required depth.

**2** The assembly, consisting of roof bolt, square roof plate, malleable-iron shell and steel plug, is inserted in the drilled hole.

**3** Bolt head is tightened with power wrench. This draws down the plug, expanding serrated leaves of shell.

**4** The shell is anchored securely. Square roof plate furnishes additional support. Steel ties, connecting a series of holes, may be substituted.

# Mining shale in South Africa for hemisphere's largest brick company

*Coronation Brick and Tile Company*, of Durban, Natal, Union of South Africa, largest firm of its type in the southern hemisphere, uses two D Tournapull® Rear-Dumps and a Tournatractor® in its mining operations. The company supplies high quality face and common bricks for most of Natal's building trade, plus roofing tile for much of South Africa and Rhodesia.

The 11-ton Tournapulls haul shale, some stone and sand, to a feeder leading to the factory. In their spare time, Rear-Dumps also haul waste stones and boulders about 2 miles to a dump.

Meanwhile, the company's 210 hp Tournatractor is assigned to mixing materials for brick and tile. This big tractor-on-rubber dozes select overburden down the quarry face, so shovels at the bottom of the cliff can scoop up some clay along with the shale. On occasion, the Tournatractor also constructs and levels roads, as new parts of the quarry are opened.

### Tournapulls move 765 yds. daily

When hauling material to the apron feeder, each shovel-loaded Tournapull delivers 9 yards every 8 to 10 minutes. The two machines move 10 loads in a 50-minute hour.

Not only are Tournapull Rear-Dumps stronger, and have better loading capacities than competitive haulers on the project, say company officials, but they work much faster. According to records kept for 21 days, each Tournapull averaged 42½ nine-yard loads of shale daily. Three competitive 4-yard haul units on the job moved an average of 37.6 loads per day.

Tournatractor dozes special clay overburden toward top edge of cliff, seen in large photo above. At the foot of the bank, material is mixed with shale, and shovel-loaded into Tournapull Rear-Dumps for hauling to the factory.

Says Owner S. M. Fletcher, "LeTourneau-Westinghouse machines maneuver excellently. They are rugged. They are doing a good job for us." Quarry Supervisor H. J. Davies adds, "I have worked on many projects in Africa with LeTourneau-Westinghouse equipment. These machines work better than any other earthmoving product!"

### Give excellent service

Each of the Tournapull Rear-Dumps has been used for more than 7,000 hours. Tournatractor has been used in excess of 5,000 hours. All three machines have given excellent service, with an exceptional record for availability say company officials.

Even though Tournapulls haul very large rocks, the big machines withstand loading shocks very well, according to Mr. Davies. Tires have worn especially well, although they are always rolling in hard, sharp shale.

### Easier to lubricate

Maintenance is easy, too. Men on the job find lubrication points on LeTourneau-Westinghouse equipment more accessible than on any other machines.

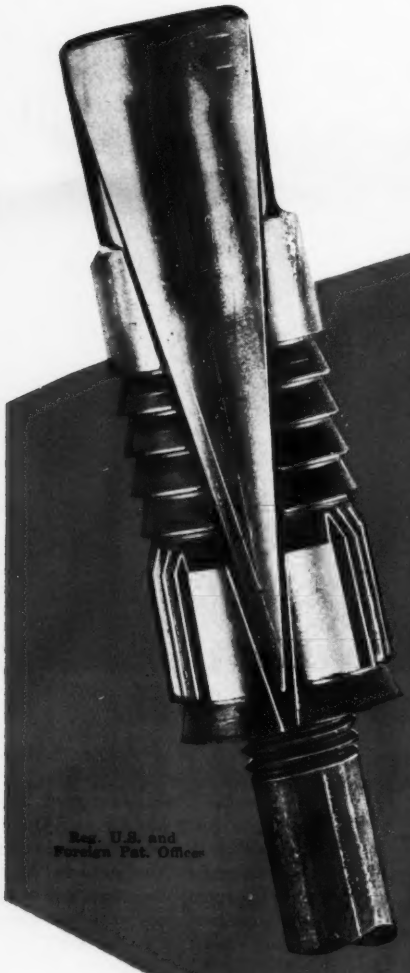
Write us for more information on LeTourneau-Westinghouse equipment.

DRCT-1436-M-1

**LeTOURNEAU-WESTINGHOUSE COMPANY,** PEORIA, ILLINOIS

*A Subsidiary of Westinghouse Air Brake Company*

**Where quality is a habit.**



Reg. U.S. and Foreign Pat. Office

# THERE'S A BIG DIFFERENCE

## 4 Million* Roof Bolts Per Month—Now Being Installed In Mines—

* Estimated usage in 1956

THE TREMENDOUS growth of roof bolting can be directly traced to the advantages it offers and gives the mines that have replaced conventional timbering methods with roof bolts. Roof falls that usually result in accidents, operating delays and clean-up costs have been reduced to a minimum. Safety records are greatly improved while increases in production have materially reduced the average cost per ton, per man. Being the largest exclusive manufacturer of roof bolting products—PATTIN Manufacturing Company has the largest and most complete line of outstanding shells, bolts, etc. Our roof bolting experts are available for consultations and tests. Write or phone us at your convenience.

Shown above is the PATTIN style D-1 expansion shell. Samples of the D-1, D-2 or D-3 will be furnished upon request.

### In Western States

PATTIN expansion shells are available and serviced exclusively through Colorado Fuel and Iron Corporation, Denver, Colorado. Western mining companies may contact them direct for information and consultation.

PATTIN *"The Pioneer in Roof Bolting"*

# PATTIN MANUFACTURING COMPANY

*"69th Year"*

MARIETTA, OHIO

# HERE'S LOADER MOBILITY . . . EXCAVATING STRENGTH

**LOADS 1½ CU YD AT A PASS . . . 2¼ yd with light materials bucket. Lifts up to 11,200 lb.**

**WORKS RIGHT UP ON A STOCKPILE where wheels dig in. Can build stockpiles higher, store many more yards of material in a given area.**

**TURNS IN ITS TRACKS . . . where many smaller loaders have to jockey.**

**DIGS INTO HARD-PACKED MATERIAL . . . exerts 20,000-lb break-out force, with 72 net engine hp and modern bucket design.**

**These are just four examples of how an Allis-Chalmers HD-6G tractor shovel offers a combination of strength, traction, flotation and mobility that enables it to replace a fleet of part-time specialized machines. You can count on it to boost production the year round. Ask your Allis-Chalmers dealer about the HD-6G . . . also the three larger tractor shovels with capacities up to 4 cu yd. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.**

**ALLIS-CHALMERS** *Engineering in Action*

# Gets the best of BAD SEAMS...

## CP Hydraulic Coal Drill

Drilling a 9 foot hole every 30 seconds in bad seams is standard for this 35 lb. coal drill. Long auger lengths are easy to handle. Its high torque motor packs the power for hard drilling . . . responds instantly. 1000 RPM auger speed holds vibration to a minimum.

Run the CP-35-HCD from the power system of cutting, timbering or roof bolting machines. Absolutely safe . . . no sparks or shock . . . no kick on stall! For details, write: *Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, N. Y.*

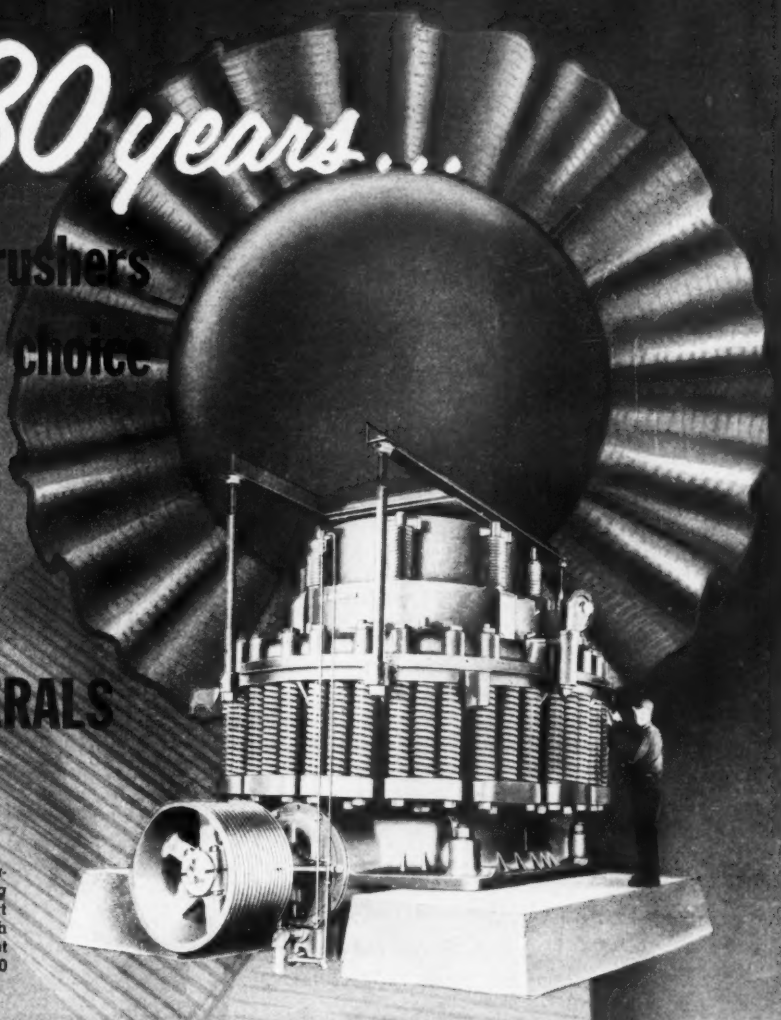
***ACCESSORIES INCLUDE:*** **Valves, gauges, junction blocks, hoses and fittings**

**Chicago Pneumatic** ***8 East 44th Street, New York 17, N. Y.***

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

# *After 30 years...*

## SYMONS® Cone Crushers are still the first choice of the world's leading producers of ORES and INDUSTRIAL MINERALS



SYMONS CONE CRUSHERS . . . *the machines that revolutionized crushing practice* . . . are built in Standard, Short Head, and Intermediate types, with crushing heads from 22 inches to 7 feet in diameter—in capacities from 6 to 900 tons per hour.

The introduction of the Symons Cone Crusher some thirty years ago marked the greatest advancement ever made in the field of reduction crushing. The immediate acceptance of this crusher by producers of finely crushed materials has had no parallel with any type of machinery used for similar service.

The dominant position which the Symons Cone Crusher has so consistently maintained in over a quarter-century of service is positive proof of its vastly superior performance in processing big tonnages of finely crushed product at lower cost . . . *and is the reason why Symons Cones are still the first choice of the world's leading producers for volume crushing of metallic and non-metallic ores and industrial minerals.*

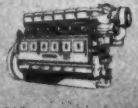
Write for further information.

SYMONS PRIMARY GYRATORY CRUSHERS

NORDBERG GRINDING MILLS

NORDBERG MINE HOISTS

SYMONS VIBRATING GRIZZLIES & SCREENS



NORDBERG ENGINES 10 to over 12,000 H.P.

SYMONS . . . A REGISTERED NORDBERG TRADEMARK KNOWN THROUGHOUT THE WORLD

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**NORDBERG MFG. CO.**

C137

MILWAUKEE, WISCONSIN

NORDBERG MACHINERY

**NORDBERG**

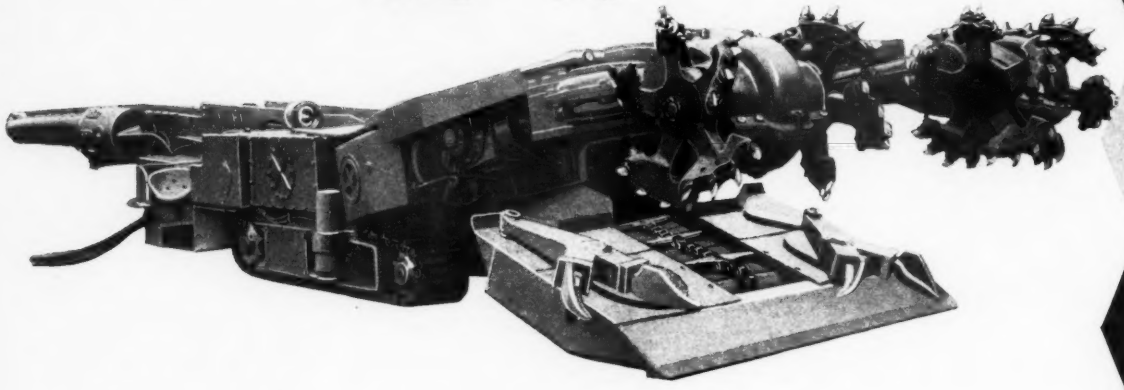
SYMONS SCREENS NORDBERG

MACHINERY FOR PROCESSING ORES and INDUSTRIAL MINERALS

NEW YORK • SAN FRANCISCO • ST. LOUIS • DULUTH • WASHINGTON

TORONTO • MEXICO, D. F. • LONDON • GENEVA • JOHANNESBURG

# HERE'S WHY THOSE WHO KNOW PREFER THE *Lee-Norse* MINER



**PATTERN CUTTING**—*only Lee-Norse has it.*

**CUTS MORE COAL WITH LESS POWER** . . . *cutters revolve and oscillate at the same time—milling the coal from the face.*

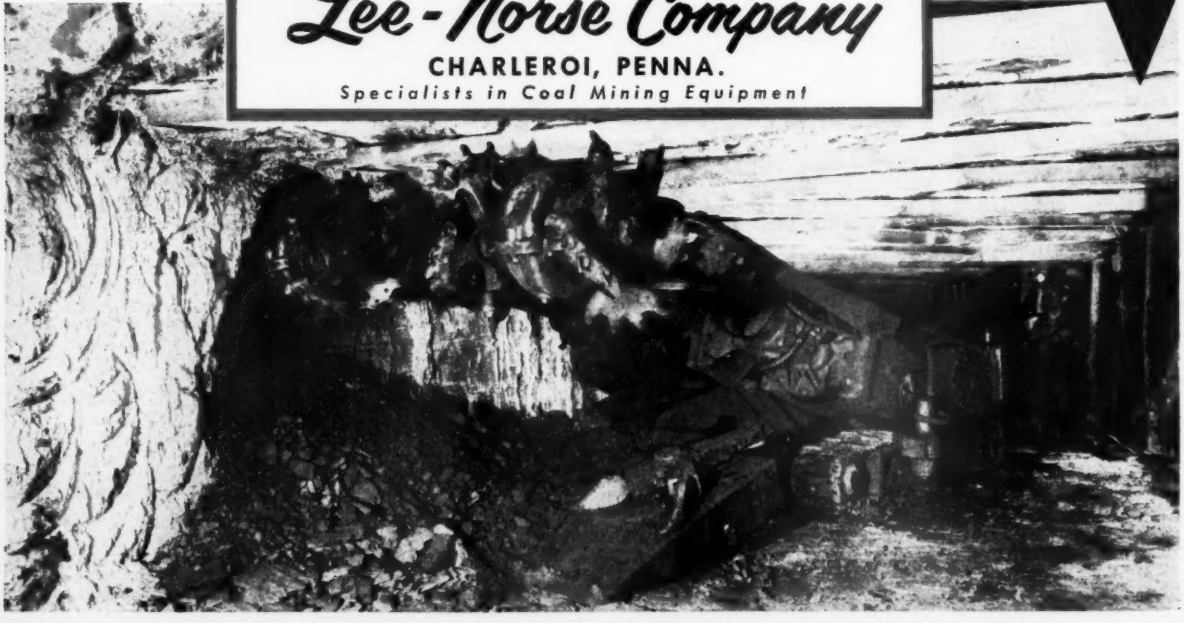
**CUTS A COARSE PRODUCT—FEWER FINES** . . . *cutter bits follow a right and left spiral direction producing a diamond pattern which breaks off in coarse cuttings.*

**A SIMPLE, STURDY MACHINE** . . . *essentially a modern loading machine on which is mounted a set of efficient cutting heads.*

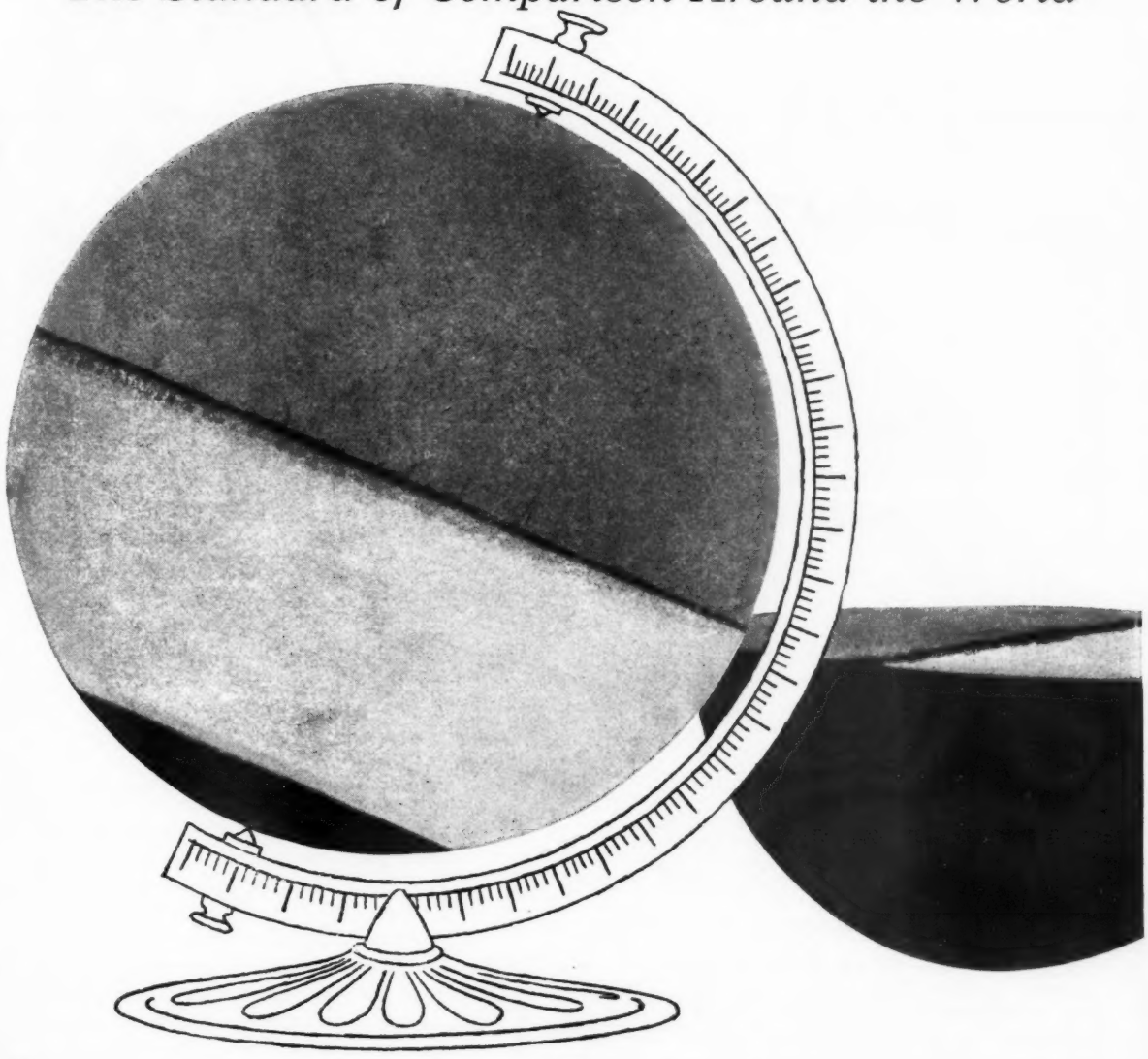
**HIGHLY MANEUVERABLE—FAST TRAMMING**. . . *not a "muscle-bound giant" . . . it quickly follows any variation in seam thickness.*

**EXCELLENT CLEAN-UP** . . . *improved dual gathering arms load all the coal into a flexible rear conveyor.*

*Lee-Norse Company*
CHARLEROI, PENNA.
*Specialists in Coal Mining Equipment*



*The Standard of Comparison Around the World*



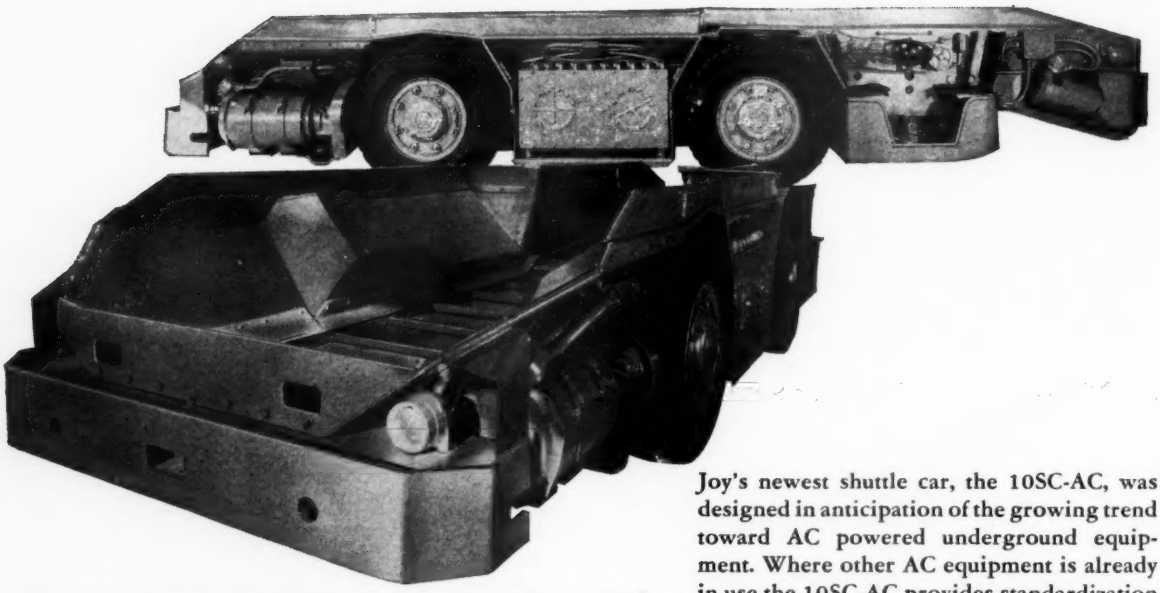
# hard and tough to the core...

Moly-Cop Grinding Balls have earned a reputation for long, economical service in the major mills of the world...and for good reason. The alloying, forging and heat treating by Sheffield assures an unvarying hardness and toughness to the core.

**SHEFFIELD**
ARMCO®
**MOLY-COP**
TRADE MARK
COPPER-MOLYBDENUM-ALLOY
*Grinding Balls*

**SHEFFIELD DIVISION** ARMCO STEEL CORPORATION SHEFFIELD PLANTS: HOUSTON • KANSAS CITY • TULSA
EXPORT REPRESENTATIVES. THE ARMCO INTERNATIONAL CORPORATION, MIDDLETOWN, OHIO

# JOY 10SC-AC
## SHUTTLE CAR



**The 90 HP 10SC-AC takes full advantage of 5 AC motors... motors which are characteristically trouble-free. Complex transmissions, torque converters, complicated gearing, numerous clutches and other potential problem spots are eliminated. Result: minimum maintenance and minimum down-time.**

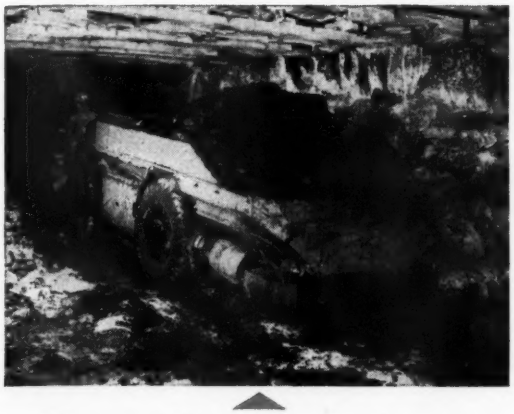
Joy's newest shuttle car, the 10SC-AC, was designed in anticipation of the growing trend toward AC powered underground equipment. Where other AC equipment is already in use the 10SC-AC provides standardization of power supplies throughout the mine . . . makes stocking and purchasing problems simpler. But more important, the 10SC-AC brings the powerful performance and extremely low maintenance of AC motors into the shuttle car field for the first time.

Two constant-horsepower, 2-speed traction motors, rated at 25 horsepower each, drive the car . . . eliminating all clutches, transmissions, and cross-drive shafts. Shifting is done automatically, electrically . . . fewer mechanical parts . . . less maintenance. Two constant-torque, 2-speed conveyor motors, 10 horsepower each, power the conveyor by direct drive without complicated transmission systems or complex gearing. These design features closely follow the proved design of Joy's DC driven car, the 10-SC, operating in the field for almost ten years.

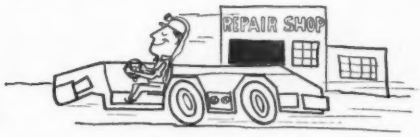
*4-wheel drive and 4-wheel steering makes the 10SC-AC extremely maneuverable in closely timbered areas.*

WSW CL 6419-144

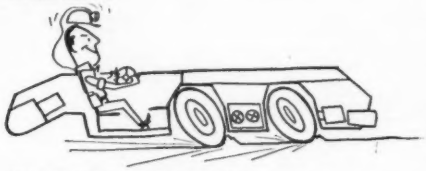
# —DESIGNED SPECIFICALLY FOR AC OPERATION



*The Joy 10SC-AC car easily carries 10 tons of material even on rough bottoms.*

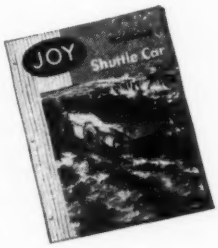



LESS MAINTENANCE—Alternating current motors are trouble free—no servicing of brushes, brush holders and studs . . . not even hand holes on the motors.



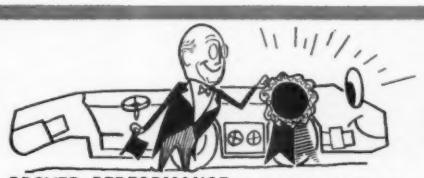
REGENERATIVE BRAKING—Standard equipment on the 10SC-AC. On down-grade, braking automatically occurs when motors are driven over their synchronous speeds.

SAME SPEED LOADED OR EMPTY—AC motors power the 10SC-AC at almost the same speed whether loaded or empty . . . keeps several cars on an even cycle . . . eliminates jams and waiting at loading point.




**Write for Bulletin 144-2**

A complete description of the 10SC-AC including dimension drawings, specifications and performance curves.

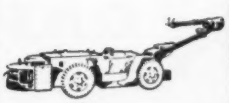


PROVED PERFORMANCE—The basic design of the car is the Joy 10-SC . . . in the field since 1948. New 10SC-AC's are now working coal.

**JOY MANUFACTURING COMPANY, OLIVER BLDG., PITTSBURGH, PA.**
**EQUIPMENT FOR MINING . . . FOR ALL INDUSTRY**

CONTINUOUS MINERS

COAL LOADERS



COAL DRILLS

COAL CUTTERS

## Flexibility plus!

# NEW GARDNER-DENVER DELUXE "AIR TRAC"®

### 210° Swing

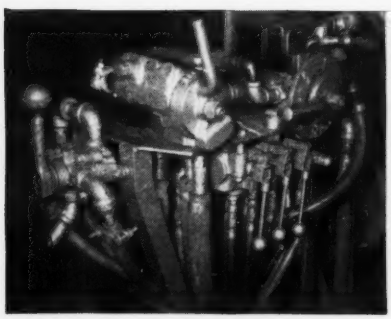
Hydraulic cylinder provides 120° swing, can be indexed for an additional 90° swing.

### 360° Dump

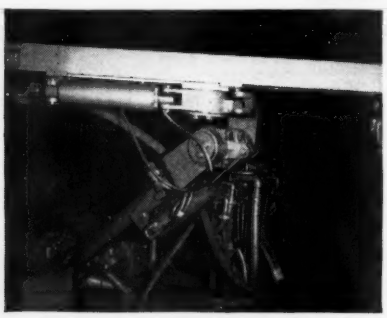
Hydraulic cylinder provides 90° dump, can be indexed a full 360°.

### 86° T-Bar Lift

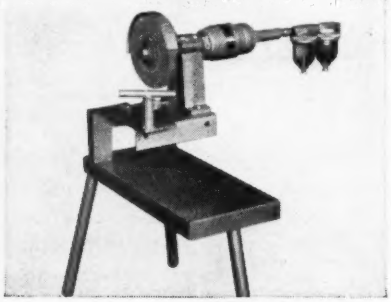
Twin hydraulic cylinders provide T-bar lift of 86° 30′, from below horizontal to nearly vertical.



New Remote Control Panel and Driver's Seat—centralized controls provide instantaneous control of swing, dump, T-bar lift, crawler tracks and all drilling operations. Designed for convenience, comfort and safety. Saves minutes and reduces operator fatigue.



New DPAT Hydraulic Drill Positioner —this creep-free hydraulic system maintains alignment at all drilling angles and avoids stuck steel. Provides fast, effortless, power positioning for all vertical, horizontal and flat lifter hole spotting.



New Model G-2 Bit Grinder—this deluxe "Air Trac" extra saves time, too. No need to send back or wait for bits —you sharpen spare bits on the job. Plus new free-wheeling drive shaft design for towing "Air Trac" . . . tool box for tools, bit and coupling storage.

**Write for bulletin**

ENGINEERING FORESIGHT—PROVED ON THE JOB
IN GENERAL INDUSTRY, CONSTRUCTION, PETROLEUM AND MINING

## GARDNER-DENVER

Gardner-Denver Company, Quincy Illinois
Export Division, 233 Broadway, New York 7, New York
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**GENERAL CABLE** SUPER SERVICE

# PORTABLE POWER and MINING CABLE

3 Conductor Type SH-D Size No. 2AWG 15KV

3 Conductor Type G Size No. 2AWG 600V P-110 BM

3 Conductor Type W Size No. 2AWG 600V P-110 BM

# with SUPERTUF Jacket

GENERAL CABLE offers a complete line of SUPER SERVICE portable power and mining cables which will stand up under the most severe operating conditions and furnish longer life and reliable service no matter how difficult the application.

All SUPER SERVICE cables are jacketed with an extra heavy duty, vulcanized in mold, double layer cord reinforced "SUPERTUF" neoprene sheath with maximum resistance to tearing, cutting, abrasion and overall mechanical abuse, and possessing outstanding resistance to water, oil, acids, alkalis, flame and effects of sunlight and weathering.

SUPERTUF neoprene jacket far exceeds the requirements of ASTM D-752, and all 600 volt SUPER SERVICE portable cables bear the official approval number P-110 BM embossed in the jacket indicating compliance with the flame resistance requirements of the Pennsylvania Department of Mines and requirements of the Federal Bureau of Mines.

**GENERAL CABLE CORPORATION**, 420 Lexington Avenue, New York 17, New York
*Offices and Distribution Centers Coast-to-Coast*

***for quality and service . . .*** **specify GENERAL CABLE**

# ANNOU

# Increased capacity ratings

THE Timken Roller Bearing Company announces an increase in the capacity ratings of most series of Timken® tapered roller bearings. Increases range up to 39%. Most are in the neighborhood of 10%. Some are negligible.

## Permits Use of Smaller Bearings

This increase in capacity ratings makes it possible for many of you to use smaller bearings. Your products can be made more compact. You can save weight. You may be able to reduce the size of your shafts and housings. And you may be able to use Timken bearings in new applications where they have not been practicable in the past.

## 3 Reasons for Increases

What led to these increases in Timken bearing capacities? Three things: First, a careful review of more than 6,000 different laboratory studies

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

# NCING!

# for Timken® bearings

of Timken bearing performance on fatigue life machines. From these exhaustive studies, conducted on an organized, scientific basis since 1924, we keep learning more and more about predicting bearing life.

Second, refinement in the method of analyzing these studies mathematically.

Third, a careful review of the life of millions of Timken bearings in the field.

### How Much Can This Save *YOU?*

To find out how the new capacity ratings affect the types and sizes of Timken bearings in which you are interested, call your Timken bearing representative or write our Engineering Department. We'll be glad to work with you at the drawing board stage. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

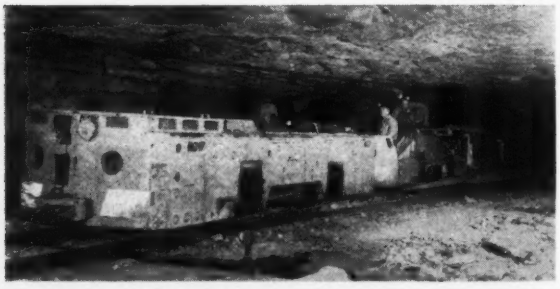
*TAPERED ROLLER BEARINGS ROLL THE LOAD*

# *Undercutting Tough Potash*

# 3 SHIFTS A DAY—7 DAYS A WEEK—FOR ONE YEAR

Recently, a Goodman rubber tired cutter performed round-the-clock for a whole year cutting tough potash seams. Under this rugged routine, without a major overhaul, the Goodman cut some 172,000 lineal feet of face yielding 690,000 tons of potash.

Face widths varied from 28′ to 36′, distance of travel from place to place was often as great as 2,000 feet, and in some instances there was waiting time before the cutter could go into action. One timed cut across a 32′ face showed an elapsed time of 18½ minutes, including 2½ minutes for a 9′ sumping cut.



Main line haulage in this potash mine is capably handled by Goodman 20-ton locomotives in tandem. For intermediate haulage the Goodman Ropebelt conveyor provides many cost saving advantages.

Here are "reasons why" the Goodman Type 2410 Cutter performs so well in hard service:

- **Motors custom-designed and built by Goodman for the mine service imposed.**
- **Strong, rigid, end-to-end machine construction with balanced weight distribution—easy to "slew" machine when necessary.**
- **Quick responding hydraulic control with all levers conveniently grouped on both sides of machine.**
- **Fast tramming with positive control of speed and steering.**
- **Positive, efficient disc type brake.**
- **Good road clearance—a life saver for tires.**

These plus an unmatched cutting ability and a low, low maintenance cost make the Goodman Cutter a profitable investment—an investment that can be written off in terms of greater productivity and lower cost per ton. Let us give you the full story.

**GOODMAN**

MANUFACTURING COMPANY

Halsted Street and 48th Place, Chicago 9, Illinois

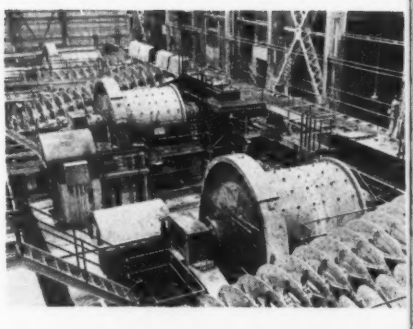
CUTTING MACHINES • CONVEYORS • LOADERS
SHUTTLE CARS • LOCOMOTIVES • CONTINUOUS MINERS

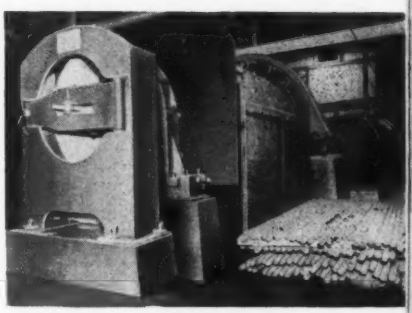
***Use Genuine Goodman Replacement Parts***

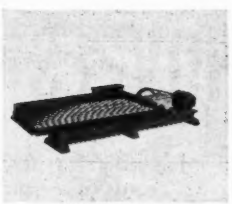
# see what Marcy can do for YOU!

## Marcy Ball and Rod Mills Increase Capacity up to 33%

Marcy Ball and Rod Mills both incorporate the Marcy principle of grinding... "rapid change of mill content is necessary for high efficiency." This is accomplished by use of the Marcy *full-grate* discharge on ball mills and the *open-end* feature on Marcy rod mills. These features result in a low pulp line which provides an active, effective grinding mass to act on particle size reduction only... there is no wasteful cushioning action by high pulp levels. There is a faster migration of fines than oversize particles, thus less overgrinding. This basic principle of grinding incorporated in Marcy Mills has proved, in hundreds of installations, to give greater output with lower KWH per ton, up to 33% more tonnage compared with the same size overflow mills. Marcy Mills are made in sizes up to 12' 6" diameter. Every Marcy is backed by more than 40 years grinding experience.

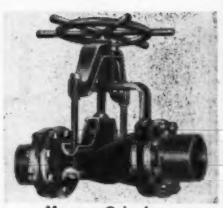






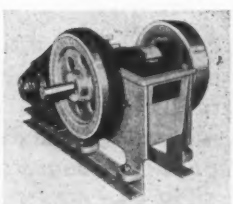
**Wilfley Tables**
For separation of any material amenable to gravity concentration.

**Marcy Pulp Density Scale**
Gives direct readings.



**Massco-Grigsby Pinch Valves**
Rubber and neoprene sleeves. 1" to 14".

**6" x 10" Massco Gy-Roll Reduction Laboratory Crusher**



**4" x 6" Massco Laboratory Jaw Crusher**

**Massco-McCool Pulverizer**
Disc type grinder. No gears.

## NO EXTRA CHARGE FOR MARCY EXPERIENCE

*Write for Catalogs*

## THE MINE AND SMELTER SUPPLY CO.

DENVER NEW YORK SALT LAKE CITY EL PASO

SALES AGENTS AND LICENSED MANUFACTURERS THROUGHOUT THE WORLD

## world famous for production...

# P&H ELECTRIC SHOVELS WITH MAGNETORQUE* and ELECTRONIC CONTROL

The increasing worldwide acceptance of P&H Electric Shovels is the direct result of production records made possible by Magnetorque, plus P&H Electronic Controls and P&H Basic Design.

P&H Magnetorque transmits power from the hoist motor to the dipper electromagnetically for faster action, eliminating shock and impact from the hoist gear train and motor. Electronic controls provide faster, more efficient action, insuring higher output. In addition, P&H All-Welded design with scientifically distributed weight provides greater strength and stability, makes P&H Electric Shovels equal to the toughest jobs.

Worldwide demands for P&H Electric Shovels (available from 3½ to 8 cu. yd. capacity) make it wise to anticipate your *future* needs NOW!

*T. M. of Harnischfeger Corporation for electro-magnetic type coupling.

## HARNISCHFEGER

Construction & Mining Division
Milwaukee 46, Wisconsin

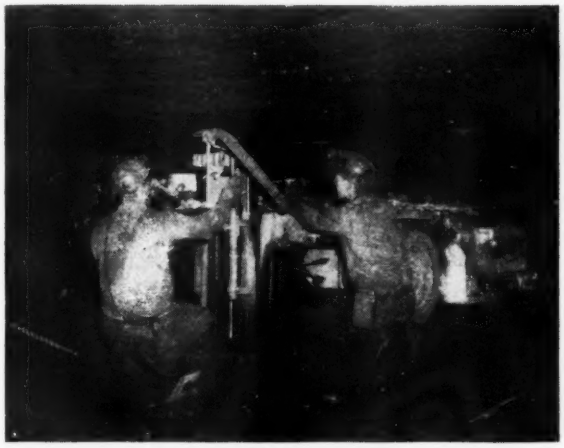
*the* P&H *Line*

TRUCK CRANES · DIESEL ENGINES · POWER SHOVELS · HOISTS · SOIL STABILIZERS · WELDING EQUIPMENT · OVERHEAD CRANES

[ *Page 28* ]

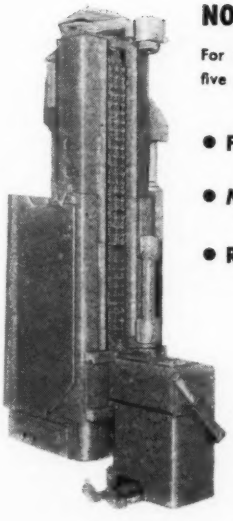
# BUILT FOR BOLTING IN YOUR MINE!

**That's why more mines use FLETCHER Roof Control Drills than all other makes combined!**



For **LOW** Seams

For **HIGH** Seams



**NOW . . . Continuous MINER DRILLS**

For installation on ripper miners as shown, and five new styles to work with boring-type miners.

**ADVANTAGES**

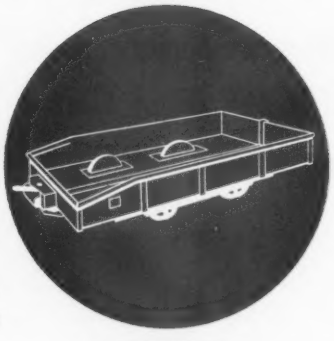
- **Flex-mounting to allow bolting while mining.**
- **Mast against roof to provide safety and stability.**
- **Rugged construction for low maintenance.**

**Fletcher ROOF CONTROL DRILLS**

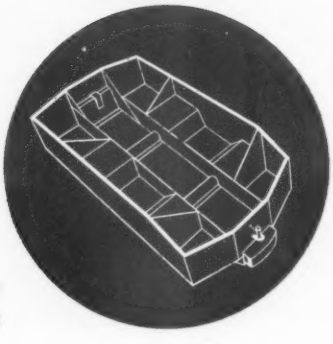
THERE are FLETCHER Roof Control Drills designed for seams varying from 30" to 14 feet in height. *And,* because each mine has special requirements — variations in Roof Height, Roof Hardness, Bolt Length, Bolt Pattern, Capacity, Mine Voltage, Mining System, etc. — *FLETCHER machines are tailored to meet these problems.* FLETCHER offers complete flexibility of dimensions or features to meet your specifications. So—if your roof drilling problem is high bit cost, tough materials, or slow bolt installation rate — you'll want to learn more about FLETCHER Roof Control Drills. See your FLETCHER representative.

**J. H. FLETCHER & CO.** | P. O. Box 353, HUNTINGTON 8, WEST VIRGINIA Phone 44186

**DROP BOTTOM**
4 wheel or 8 wheel



**END DUMP**
4 wheel



**ROTARY DUMP**
4 wheel or 8 wheel

# acf MAKES ALL THREE TYPES

No matter what type of car your mining operations call for acf has a car to fit your needs. acf mine cars are built in all types and sizes from 2 to 30 tons, or more.

For safety, low maintenance and high speed constant haulage all acf mine cars have special features developed through many years of experience in design and manufacture.

Anti-friction bearings in the load-support wheels permit safe high speed from loading point to unloading point and back again for more. Automatic couplers make car handling safer and faster. acf double-action spring bumpers lower maintenance on everything from trackage to locomotive...provide smoother, safer hauling.

For complete information about the full line of acf Constant Haulage Mine Cars in all sizes and types contact the nearest acf sales office or discuss your haulage problems with one of our sales representatives.

**acf MINE CARS**
***FOR CONSTANT HAULAGE***

**AMERICAN CAR AND FOUNDRY**
**Division of acf Industries, Incorporated**

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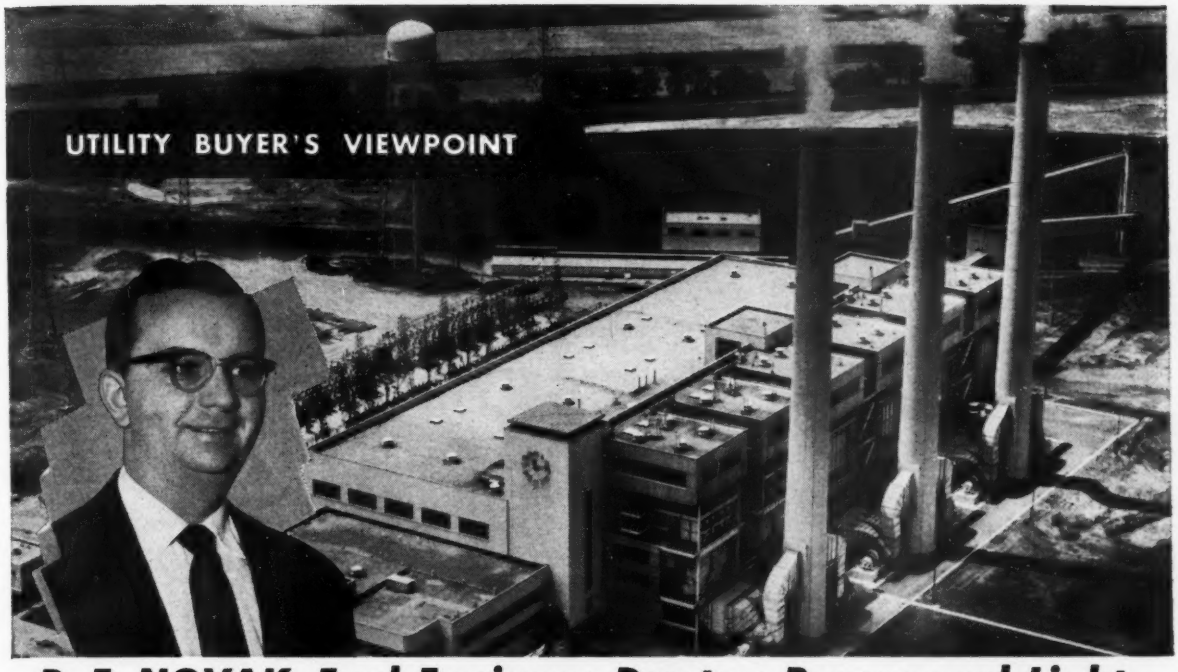


## *R. E. NOVAK, Fuel Engineer Dayton Power and Light Company says:* "To us reliability means—

# UNIFORM QUALITY TODAY, TOMORROW AND YEARS FROM NOW"

If a coal's quality fluctuates from one extreme to another, due to lack of control over preparation, it means penalties or premiums to the shipper and his producer.

To feel that penalties adjust all evils in a partnership that must exist between a large coal consumer and its supplier, is without foundation. The high costs of transportation of non-combustibles, excess moisture, sulphur, and clerical detail can impose hidden expense and damage to efficiencies and equipment out of proportion to any adjustment in the f.o.b. mine price.

For this reason, we believe reliability of the shipper must also mean the ability to produce a quality coal today—tomorrow—and a year from now.

R. E. Novak
Fuel Engineer
Dayton Power and Light Co.

### *When you build your next preparation plant*

Tons of steel, its artful fabrication, even its appraised components, lack efficiency unless its design and details provide positiveness and flexibility to variable load capacities and market demands.

### *Think—talk and live the preparation and handling of coal*

To save your time—your money, and perhaps your business, Roberts & Schaefer highly experienced specialists provide a store-house of proven experience and up-to-date knowledge on every functional process in coal preparation and design engineering.

### *Cooperative, too!*

Roberts & Schaefer Company and its suppliers have cooperated with its customers to make possible over 350 pages of favorable publicity in leading coal publications to advise large and small coal consumers of our mutual accomplishments.

### EXPERIENCE

**RAYMOND WAGNER**
**Director of Engineering**
HAS PARTICIPATED IN THE DESIGN, CONSTRUCTION AND ENGINEERING OF OVER 250 COAL PREPARATION PLANTS.

RAY WAGNER, during the past six years as Chief Engineer for R & S, has had the responsibility and experience of completion and successful operation of over 150 coal preparation plants in United States and foreign countries.

Wagner and his staff comprise 60 graduate engineers with degrees in structural, mechanical and electrical engineering. This wealth of knowledge and experience is accountable for the successful and profitable operation of every R & S coal preparation plant.

Wagner is a graduate engineer with a degree from the University of Illinois. Prior to coming to R & S, Wagner spent 15 years in design and field construction engineering. Since 1943, he has been associated with Roberts & Schaefer Company. His experience includes coal handling, coal preparation, construction and design.

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**ROBERTS AND SCHAEFER COMPANY**

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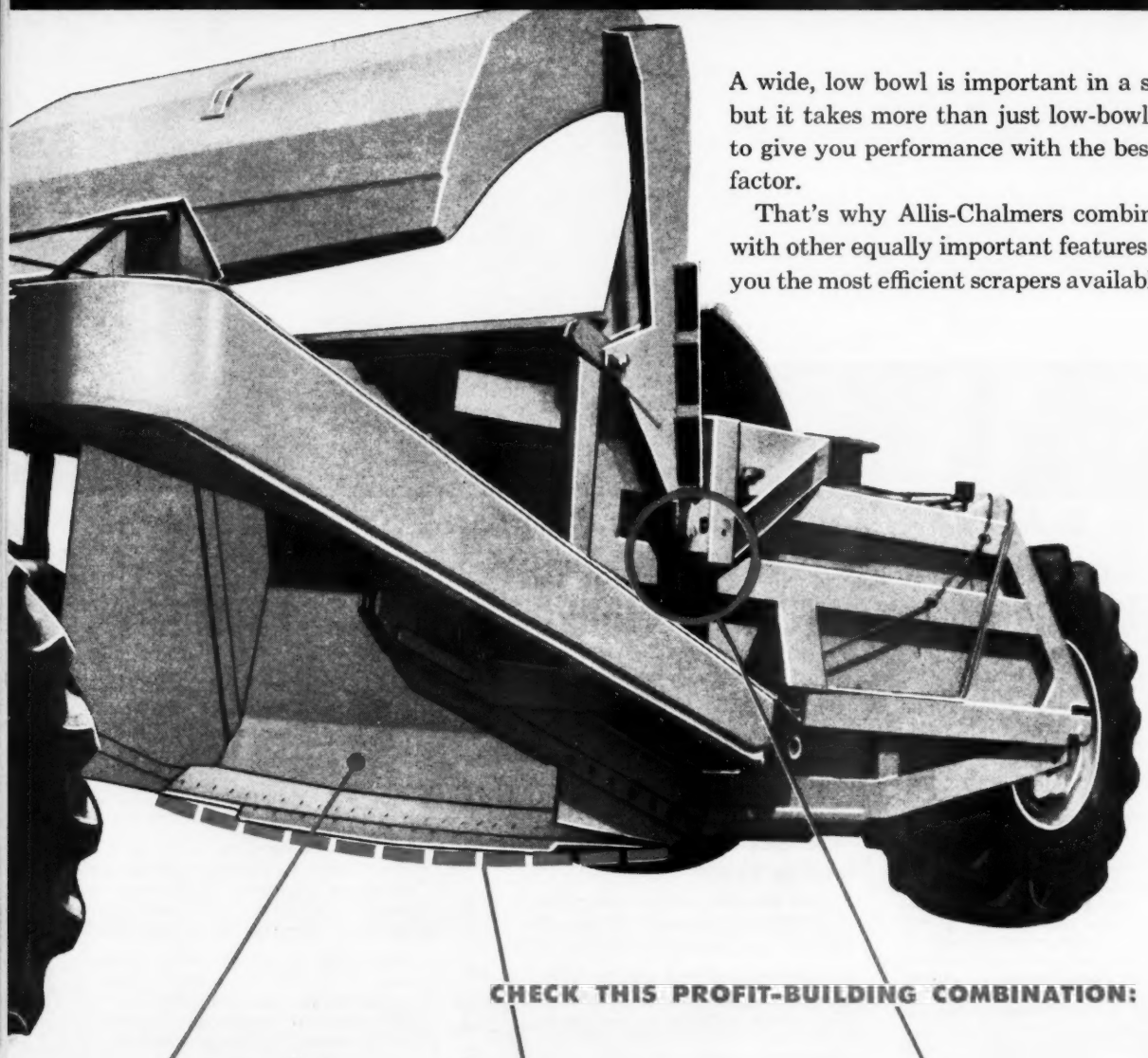
**ROBERTS** R&S AND COMPANY **SCHAEFER**

# The Low-Down on Low-Bowl Scrapers



A wide, low bowl is important in a scraper, but it takes more than just low-bowl design to give you performance with the best profit factor.

That's why Allis-Chalmers combines this with other equally important features to give you the most efficient scrapers available.

**CHECK THIS PROFIT-BUILDING COMBINATION:**

**1.**

Low, wide-bowl design for fast, heaped loading.

**2.**

Curved bowl bottom and offset cutting edge for faster, easier penetration and live, boiling loads that fill every corner of bowl.

**3.**

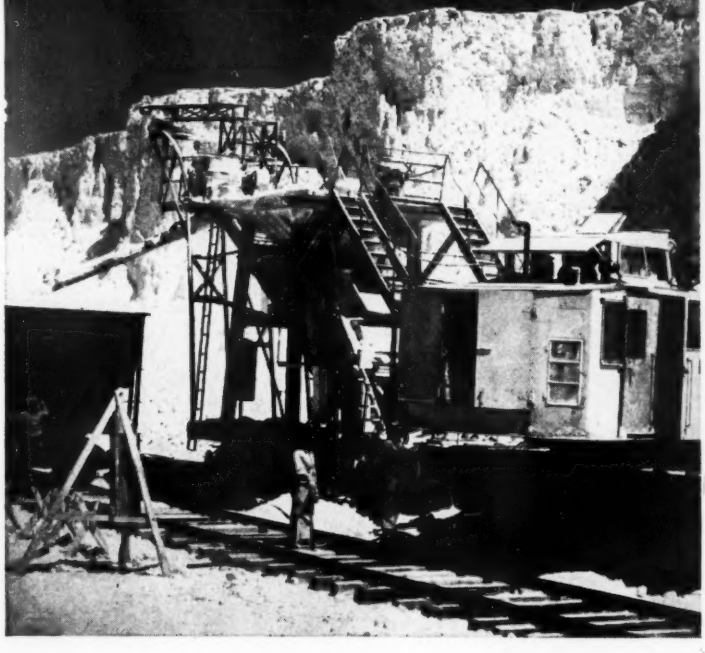
Patented apron-ejector linkage combines high apron lift with positive, forward forced ejection—permits either quick, complete dump or smooth, even spreading.

Your Allis-Chalmers dealer will be glad to discuss these and many other profitable advantages with you. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

**ALLIS-CHALMERS** *Engineering in Action*

# SULPHUR

## helps to create HEADLINE products



**Thiokol®**

"Thiokol" synthetic rubber, is an organic polysulfide elastomer. One of its many uses is in solid propellents for long range and high altitude missiles. In liquid form, "Thiokol" synthetic rubber mixed with an oxidizer, is poured into specially designed combustion chambers of rockets. It helps to give stability to the fuel charge and resistance to shock. It promotes uniform burning. When the rocket motor is ignited the mixture burns with great intensity and generates large volumes of gas to propel the rocket.

Solid propellents made with "Thiokol" synthetic rubber have proved their value in rockets over liquid propellents in many ways: they are less costly and easier to manufacture—simple and rugged construction makes handling and launching easier and safer—fuel tanks and complicated feed systems are eliminated.

"Thiokol" synthetic rubber is a product containing a high percentage of Sulphur—its name being derived from the Greek words for sulphur and glue. Here is another example of the continually broadening field in which Sulphur is an important and necessary element.

**A trade name of Thiokol Chemical Corporation.*

## Texas Gulf Sulphur Co.

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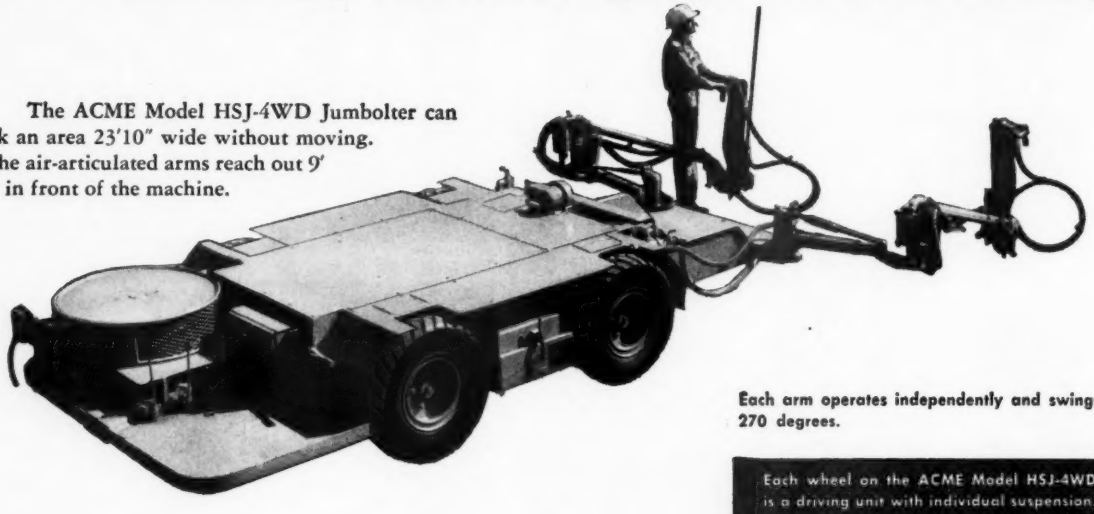
Sulphur Producing Units
- Newgulf, Texas
- Moss Bluff, Texas
- Spindletop, Texas
- Worland, Wyoming

# ACME jumbolter now has 4 wheel drive

## plus elevating platform for greater manuverability

The ACME Model HSJ-4WD Jumbolter can work an area 23'10" wide without moving. The air-articulated arms reach out 9' in front of the machine.

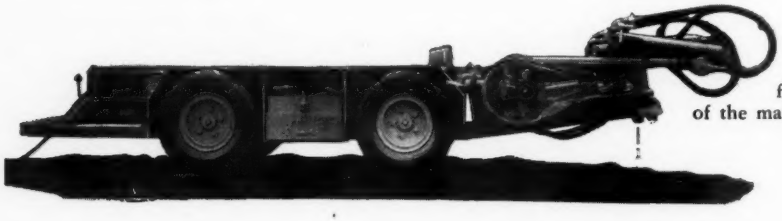


Each arm operates independently and swings 270 degrees.

Each wheel on the ACME Model HSJ-4WD is a driving unit with individual suspension. Large gear reducers are rugged enough to withstand the roughest floor conditions.

The versatile ACME Model HSJ-4WD Jumbolter is now equipped with tractor-type 4 Wheel Drive permitting shorter turning radius. Left hand and right hand wheels are integrated units so that by reversing the wheels on one side while driving forward on the other side the Jumbolter can be made to turn in almost its own length.

Available with either one or two air-articulated arms, each individually controlled, the ACME Jumbolter permits bolting in a wide flexible pattern from 8' to 10' back of the working face.



The front platform of the Model HSJ-4WD can be elevated 8" to clear floor obstructions during forward movement of the machine. Hydraulic cylinders raise and lower the platform. A locking device holds platform for in-tram position. Complete details of Model HSJ-4WD are given in Bulletin 4WD.

**ACME Machinery Company**

WAREHOUSE & SALES OFFICE
MORGANTOWN, W. VA.

**WILLIAMSON, WEST VIRGINIA**

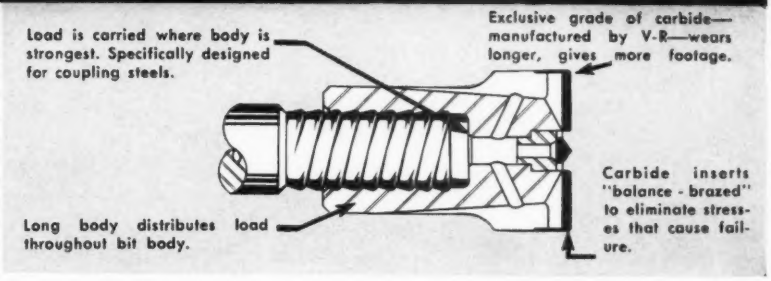
REPRESENTATIVES IN PRINCIPAL
MINING AREAS

# NEW! V-R "X" Style Percussion Bit

## Non-Rifling

## Proved best by test

**Bottoming Type**


Load is carried where body is strongest. Specifically designed for coupling steels.
Exclusive grade of carbide—manufactured by V-R—wears longer, gives more footage.
Carbide inserts "balance - brazed" to eliminate stresses that cause failure.
Long body distributes load throughout bit body.

| Thread Type | Bit Sizes |
|---|---|
| 600 | 2½ through 4½ |
| 700 | 2¾ through 4½ |
| 1000 | 4 through 5 |

## Prevents Squaring in the Hole

The new V-R "X" type carbide tipped rock bit eliminates squaring in the hole often encountered with cross-style bits. It drills clean, round deep holes faster at lower cost than any other bit you can buy.

**Exclusive V-R Carbides**—developed *and manufactured* by V-R, a leader in the carbide industry since 1930.

**Faster Penetration**—the impact load is carried a shorter distance than with a shoulder type bit, producing greater penetration on every impact.

**Longer Thread Life**—load on the threads is much less than in shoulder type bit, minimizing chance of thread strippage.

**Less Chance of Ring-off**—the major impact load is carried at the bottom of the bit body, reducing load on the skirt which is the primary cause of rock bit ring-off.

**"Balance-Brazed" Carbide Tips**—prevent stresses that cause premature bit failure.

Try them . . . and you'll buy them—the bits that are beating them all: V-R BITS.

*Ask for percussion bit catalog and prices*

Representatives and Dealers in Principal Cities

**Vascoloy-Ramet Corporation**

SUBSIDIARY OF FANSTEEL METALLURGICAL CORPORATION

**806 Market Street • Waukegan, Illinois**

M-635

# Kaiser Steel Triples Drilling Footage With Bucyrus-Erie Rotaries

As part of a general modernization of its Eagle Mountain (Calif.) mine in 1955, Kaiser Steel Company added a Bucyrus-Erie 50-R rotary for drilling blast holes in the iron mines of the West.

At Eagle Mountain, the new drill was put to work in the toughest drilling a 50-R had encountered up to that time. So outstanding were the footage records of this drill that within 6 months it was able to replace four churn-type drills. In 1956, a second 50-R was purchased.

Drilling 9⅞-in. holes, the 50-R averaged over three times as many feet per drilling hour as a churn-type drill putting down 9-in. holes. Among the features contributing to this fine performance is the ability of the operator to vary the speed of the 50-R's drill rotation and its down pressure. This means the machine handles all formations, hard or soft, with maximum speed and effectiveness. On the 50-R, hole may be drilled continuously for the full length of the drill pipe — 32 ft. 9 in.

For additional economy, cuttings from the drill hole are piled next to the hole for later use as stemming material. Bits are cooled by compressed air, and compressed air is used to remove cuttings. Fine cuttings are picked up and handled by a precipitator.

When drill pipe is added or removed, manual effort is eliminated by a remote-controlled power-driven drill pipe rack. Through these and other features, the 50-R has eliminated many man hours, considerable equipment, congestion, and cost from the drilling operation.

The features of the electric-powered 50-R are also available in the smaller Bucyrus-Erie 40-R, equipped with either diesel-electric or full electric power. We have detailed, illustrated literature on both models. Write for a copy today.

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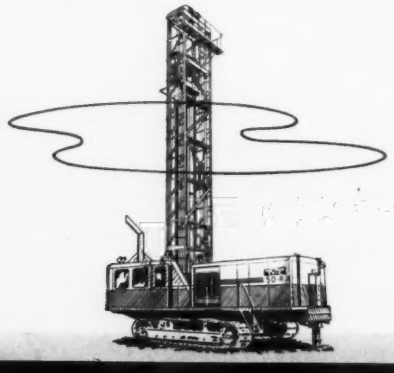
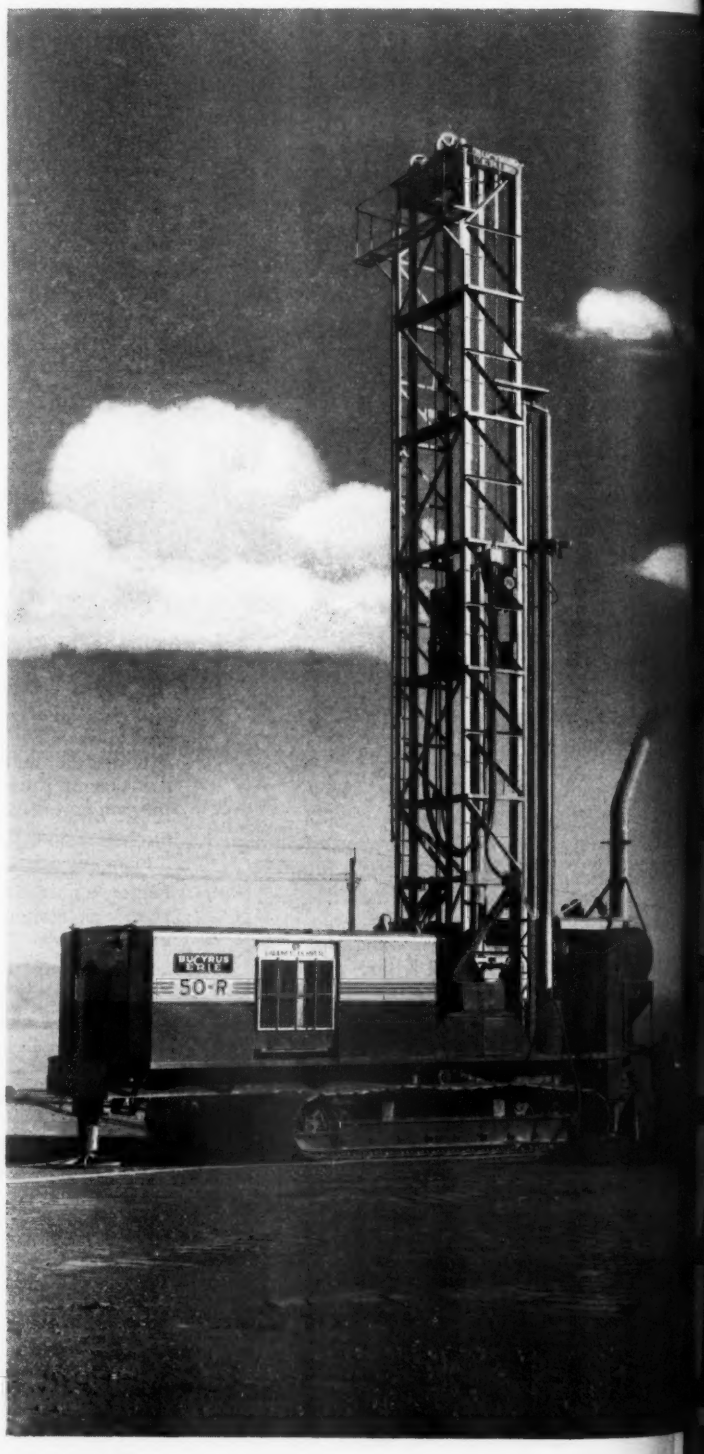
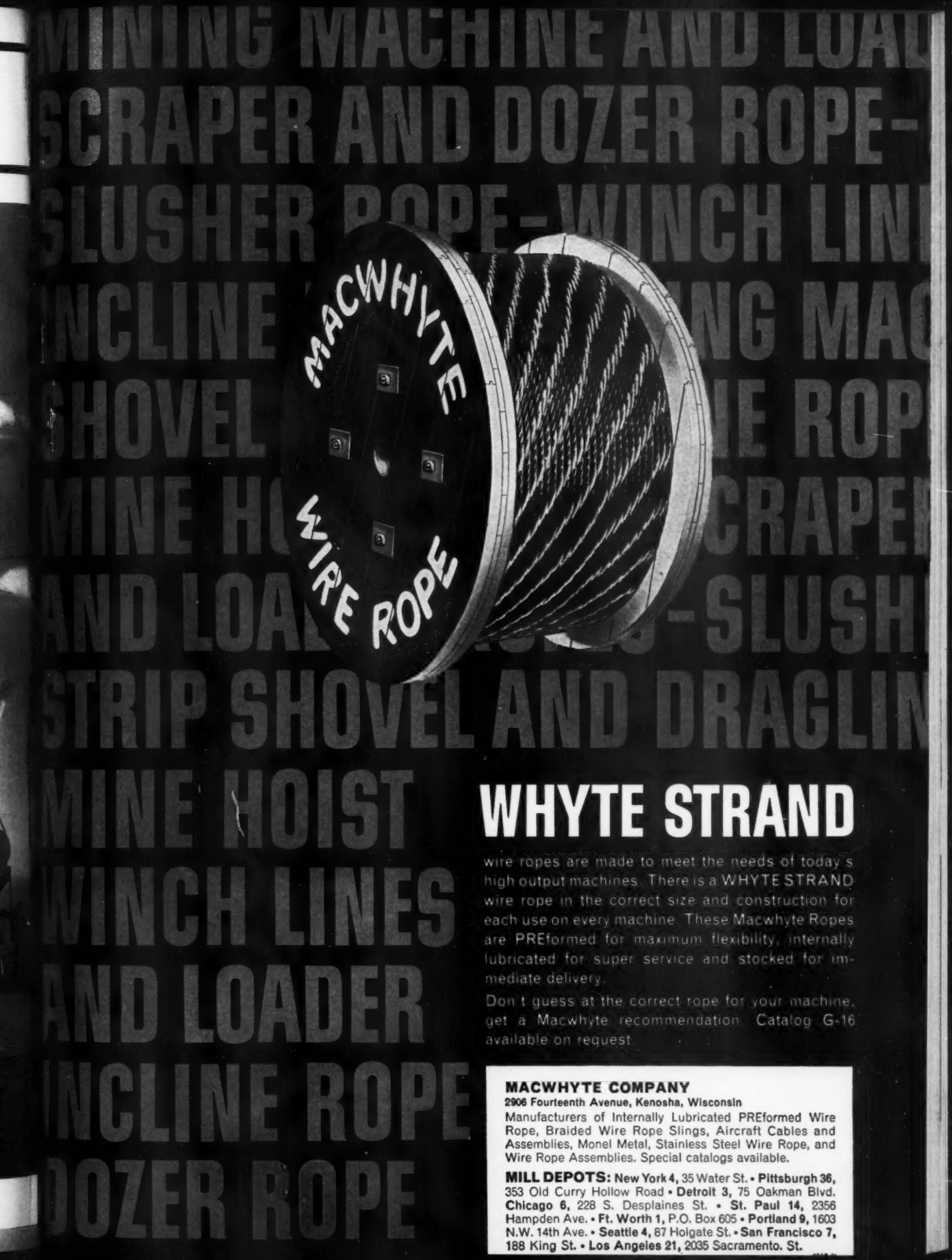





BUCYRUS ERIE SOUTH MILWAUKEE, WISCONSIN




# WHYTE STRAND

wire ropes are made to meet the needs of today s high output machines. There is a WHYTE STRAND wire rope in the correct size and construction for each use on every machine. These Macwhyte Ropes are PREformed for maximum flexibility, internally lubricated for super service and stocked for immediate delivery.

Don t guess at the correct rope for your machine. get a Macwhyte recommendation. Catalog G-16 available on request.

**MACWHYTE COMPANY**
**2906 Fourteenth Avenue, Kenosha, Wisconsin**
Manufacturers of Internally Lubricated PREformed Wire Rope, Braided Wire Rope Slings, Aircraft Cables and Assemblies, Monel Metal, Stainless Steel Wire Rope, and Wire Rope Assemblies. Special catalogs available.

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How to get better coal hauler engine performance—

use **STANDARD DIESEL FUELS**

STANDARD Diesel Fuels—now with STA-CLEAN*—deliver the *big* benefits that help you get (1) the power your coal hauler engines are rated to deliver, (2) the performance economy you must have, (3) the low maintenance costs that mean profitable operations.

STA-CLEAN is a STANDARD Diesel Fuel exclusive. This additive prevents fuel-injector sticking, insures clean burning of the fuel, prevents rusting of tanks, fuel lines, and injector parts.

Clean fuel. Standard exercises special care in handling diesel fuel to make sure it's delivered to you as clean as it was when it left the refinery. Contamination is eliminated. There's no foreign matter in the fuel to cause engine failure or maintenance problems.

Balanced distillation of STANDARD Diesel Fuels means good, as well as economical, performance; and with cleaner engine operation, you may be able to extend overhaul periods for your coal haulers.

Low pour point. STANDARD Diesel Fuels delivered to operators in cold climates have a pour point of —20° F. or lower . . . plenty of margin here to insure uninterrupted operation at low temperatures.

Get the facts about STANDARD Diesel Fuels from your Standard Oil industrial lubrication specialist. There's one of these specialists near you in any of the 15 Midwest and Rocky Mountain states. Or write Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

*Trade Mark

**STANDARD OIL COMPANY**
(Indiana)

STANDARD

**Attaching shielding ground wires** to grounded messenger, workman completes joint in Anaconda 250 Mcm, 15,000 volt, grounded neutral, butyl-insulated, shielded, neoprene-jacketed cable in underground western mine.

# What's this--Anaconda Aerial Cable underground?

Although the use of aerial cable underground sounds slightly incongruous, more and more mines are finding that it makes good sense. Good dollars and cents, too.

Cable is out of the way of damage by equipment, is easier to move, better for re-use. And there's no ditch to dig or fill. Simple installation, easy jointing and tapping reduce time and labor.

But there's more. Butyl insulation gives Anaconda mine power cable (aerial or otherwise) long-aging characteristics, improved resistance to moisture, ozone and heat. Neoprene jacket is rugged, tough – has real flexibility, resists rock cutting, impact, flame, sun and corrosive mine water.

Your Anaconda distributor has the facts and can help you choose the cable best suited to your needs. Call today! Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.

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**see the Man from ANACONDA®**

**for MINE POWER CABLE**

# SMIDTH

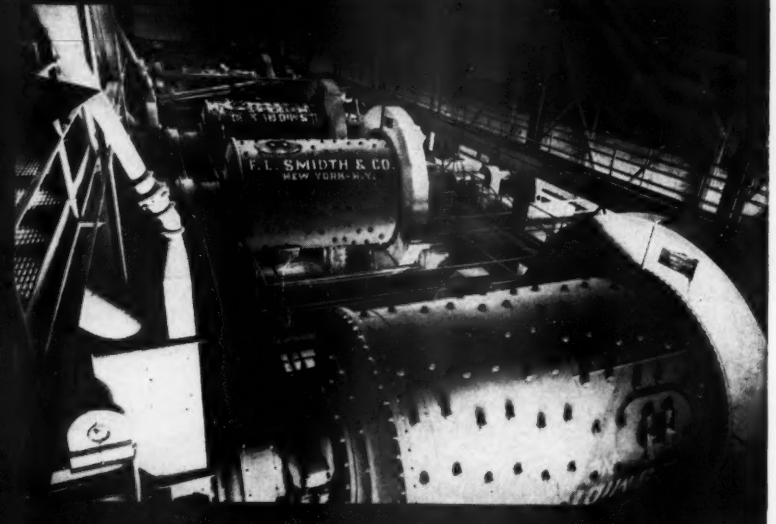
## Rotary Kilns

For sintering, nodulizing, calcining, desulphurizing, oxidizing and reducing roasting—coolers, precoolers, pre-heaters, recuperators—and auxiliary equipment.

## Grinding Mills

Ball mills, tube mills and multicompartment mills—open or closed circuit—wet or dry grinding also airswept for grinding and drying.

Over 1,000 Smidth Rotary Kilns and over 5,000 Grinding Mills supplied all over the world.

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This operation cut production costs by teaming a six-yard shovel with Mack LVX's (rated capacity, 22½ tons). Powerful engines, increased efficiency of driver-engineered cabs, unmatched handling ease and maneuverability afforded by hydraulic steering and practical transmission ratios with torque converters, and many exclusive features, give Macks faster load-handling characteristics.

# Tighter truck schedules reduce production costs

Today, many operators are cutting production costs by using larger shovels and fewer trucks making faster trips. This requires extra-capacity dumpers that are quicker, easier to handle, and rugged enough to withstand five- and six-pass loading—the kind of performance more and more operators find they can get from Mack off-highway dumpers (15- to 34-ton rated capacities).

Why not contact your Mack representative for a look at these big Macks in action on a nearby job? When you see how quickly Macks move extra-capacity loads, how easily they can be spotted under shovels and at dumping sites . . . you'll understand why operators are teaming large-capacity Macks with bigger shovels to cut production costs. Mack Trucks, Inc., Plainfield, New Jersey. In Canada: Mack Trucks of Canada, Ltd.

**MACK**
***first name for***
**TRUCKS**

5335

# reduce drift support costs...

# *with* CF&I ROCK BOLTS and REALOCK FABRIC

When you use CF&I Rock Bolts and Realock Fabric for drift support, you know you're using a method that:

- **Is fully tested for safety.**
- **Offers proved savings over older methods (35% less than timber square sets and 30% less than wedge-type bolts and landing mats, according to tests conducted by one of America's most progressive mining companies).**

Why does the combination of CF&I Rock Bolts and Realock Fabric afford such economy? First, the method is much faster and more versatile than older ones. And miners are able to do their own rock bolting with the same machines used to drive the heading. This is possible because CF&I supplies ¾" high-strength rock bolts and Pattin Type D-1 expansion shell rock bolts with left-hand threads to allow tightening by the left-hand rotation of drilling machines.

Get the complete story on how you can use the safe, economical bolt and fabric method of drift support in your own operations. Write today for complete details.

**Note:** CF&I Rock Bolts of the slot-and-wedge type are also available.

***A twenty-minute color movie on Rock Bolting entitled "Make Mine Safety" is available for showing upon request through any of the district offices listed below.***

**THE COLORADO FUEL AND IRON CORPORATION**

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4601

# EDITORIALS

ROBERT W. VAN EVERA, Editor

AUGUST 1957

## COMMON DENOMINATORS

A look at the program for the Salt Lake City convention in September, pages 51 to 63, reveals an extraordinarily broad coverage of matters that are important to mining.

Miners from every corner of the nation, as well as from other countries, will take part. Individuals and representatives of many corporations—from the very large to the very small—are on the program. And the primary interests of these men range from government through all phases of industrial administration, pure science and engineering, to the many operating aspects of mineral production.

Looking at the overall picture, we are struck by the fact that the speakers, plus other thousands who will attend the meeting, recognize a fundamental concept: Regardless of individual interest or local difficulties, the basic problems in mining are common throughout the industry. It is reasonable that we should strive to solve these problems on a nation-wide and industry-wide basis.

## ANOTHER ROADBLOCK TO BUSINESS GROWTH

Now comes another threat to free enterprise—so-called "pre-merger notification" legislation—H. R. 7698. Having received House Judiciary Committee approval this measure, similar to a bill that passed the House and just failed of enactment by the Senate in the closing days of the last Congress, is now awaiting release by the Rules Committee for House floor consideration.

Briefly, it would require 60-day prior notification to government agencies of proposed corporate acquisitions or mergers. Proponents of the bill declare that such notice is necessary to apprise government officials of pending mergers and acquisitions. Actually, the practical effect of the proposal is a broad attack on all mergers — good and bad alike — through a procedural barrier that would block more good mergers than bad ones. Furthermore, it attacks a wide range of business transactions which do not involve mergers at all. This proposal is but another vehicle by which government could further hamper business growth and stymie a free economy.

As introduced the bill would adversely affect mining by complicating and reducing the opportunity for small mining concerns, who discover mineral deposits but are not in a position to develop them, to dispose of such properties, and would thus discourage new mineral discoveries. Similarly, it would prevent firms with the necessary capital and technical know-how from acquiring additional mineral reserves—their "stock in trade" —through acquisition of undeveloped and partially developed mineral properties, thus seriously curtailing the development of the nation's mineral resources.

The American Mining Congress is opposed to this legislation. In testifying before the Congressional committees, a Mining Congress spokesman stated, "It is important to remember that all mergers are not bad. There are good economic reasons why most mergers occur. Each party has something which the other needs. It may be management, or possibly an organization with techniques or know-how which cannot be obtained merely by hiring new personnel. It may be a specific physical asset. In the mining industry, it is frequently a potentially valuable but undeveloped mineral deposit. It may be better financing—smaller businesses, and especially smaller mining enterprises, are finding it more and more difficult to borrow the money they need."

It was shown that in the mining industry, as well as other businesses, mergers are often the only way for small businesses to reach a size which will enable them to provide competition for the dominant firms in an industry.

The Mining Congress pointed out that "Mining is a wasting asset industry and is constantly depleting the mineral resources contained in the ground. To continue in business it is essential that a mining company acquire new reserves to replace the minerals which are thus being consumed. This can be done in two ways—by actual exploration for and discovery of new mineral deposits, or by acquisition of partially developed mineral properties which can be brought into production as needed to replace those mines which become exhausted. Essentially, the acquisition of undeveloped or partially developed mineral properties merely affords the means by which the industry can continue to produce the basic products which we all use and need every day, and such acquisitions do not have the effect of lessening competition or of tending toward monopoly."

Fortunately, the House Judiciary Committee recognized the harm that would be done the mining industry and amended the bill to exempt from its provisions, "Any acquisition of (i) stock or other share capital of a corporation, 75 per centum or more of the market value of the assets of which consist of undeveloped or partially developed mineral, mining, or timberland properties, or (ii) the whole or any part of such undeveloped or partially developed mineral, mining, or timberland properties."

While very helpful, this exemption would not stop many of the unwarranted interferences in the legitimate and proper business activities of the mining industry that could result from the bill. Also, the Judiciary Committee report appears to reduce the scope of the mineral exemption below what the Committee intended. Pre-merger legislation remains as a potential threat to mining as well as to the entire business world.

This proposal, whether or not by design, would block many necessary and desirable corporate acquisitions and mergers and thus strike at the very heart of progress and business growth. It is to be hoped that Congress will come to realize that any such legislation is unnecessary, costly and burdensome to both Government and industry, and wrong in principle.

By switching from churn drilling to rotary and down-the-hole drilling, this western iron mine has reduced mining costs

# Blast Hole Drilling At EAGLE MOUNTAIN MINE

By MARTIN J. HUGHES
Mine Manager
Kaiser Steel Corp.

KAISER Steel Corp. obtains all of its blast furnace ore from the Eagle Mountain Mine, which is located 60 miles east of Indio, Calif., and 160 miles from the Fontana Steel Plant. At present this open pit mine is producing a daily average of 10,000 tons of ore and 20,000 tons of waste. The past few years have seen a complete change in the primary drilling practice which is employed at this property and all of the most modern drilling methods are now being used.

The material which must be broken at Eagle Mountain varies from a soft, easily drilled iron ore to a very hard, dense mixture of magnetite and hematite. The waste varies from a medium hard quartzite to an extremely dense and hard quartz monzonite. The drilling practice is further complicated by the fact that the rock has been badly faulted and fractured. This combination of conditions results in a very interesting drilling problem.

## Early Drilling Practice

When mining operations were started in 1948, all of the blast hole drilling was done by two Bucyrus Erie Model 29 T churn drills. A bench height of 30 ft was used and nine-in. holes were drilled by the 29 T machines. Holes were drilled on 12 to 15 ft centers and the rows were spaced at 15 ft intervals. All holes were drilled to a depth of 40 ft. At this time mining was being done in the Bald Eagle Pit where there was not an excessive amount of very hard rock and an average drilling rate of five ft per hour was obtained by the drills.

By 1949 three Bucyrus Erie 29 T churn drills were working in the Bald Eagle Pit. In September 1951 the first of these machines was replaced by the larger, heavier, and faster Bucyrus Erie Model 42 T churn drill. This machine was far superior to the 29 T and eventually all of the smaller machines were replaced.

In the early part of 1954, operations were moved from the Bald Eagle Pit to the North-South Pit, which is located at a distance of about 3000 ft to the east. It was here that the most difficult drilling conditions were encountered and the present drilling practice was developed.

Loading in the North-South Pit is done by five and six-yd electric shovels. The ore and waste are closely intermingled and the shovels are used to separate one from the other. In order to facilitate accurate sorting of the ore, a bench height of 30 ft has been maintained. Haulage is done by a fleet of fourteen 22-ton trucks and six 36-ton trucks. The pit is so laid out that all of the material is hauled on a favorable or a level grade. The average length of haul is 3000 ft.

Six Bucyrus Erie Model 42 T churn drills were put to work in the North-South Pit. These machines did all of the drilling for a total daily production of 18,000 tons of ore and waste. Nine-in. bits were used and all holes were drilled to a depth of 40 ft. The tool string weight was 5100 lb, using a 30-ft drill stem. Very careful attention was given to bit sharpening and tempering.

Holes were drilled on 12 to 15 ft centers and the rows were spaced at 18 ft. An average drilling rate of ten ft per hour was maintained. However, this rate was reduced to about two ft per hour in very hard material. In spite of this fact, it may safely be said that the machines did a satisfactory job, and that while they were in use the Eagle Mountain drilling prac-

tice was as good as could be expected from the equipment which was then available.

### Rotary Unit Reduces Costs

After the introduction of nine-in. rotary drills to the mining industry in 1954, Kaiser Steel began a study of the possibility of improving drilling efficiency by rotary methods. Naturally this problem was approached with considerable caution because of the hard rock and difficult drilling conditions. Engineers from the manufacturers were called in and they made an exhaustive study of the various types of rocks which were to be drilled. Drilling tests were made on each of these rocks and the results indicated that the work could be done by the rotary drill with considerable cost saving. At that time the manufacturers estimated that the Eagle Mountain material could be drilled at rates varying from 10 to 37 ft per hour, and averaging 21 ft per hour. The average bit life was estimated at 460 ft.

A study of all of the larger rotary machines was then conducted and it was decided that, because of its ability to drill large diameter holes, the Bucyrus Erie Model 50 R Rotary Blast Hole Drill would probably be best fitted for the job. One of these machines was put to work November 1954.

The rotation of the bit is variable from 35 to 115 rpm. The down pressure which can be exerted by the machine is also variable and a maximum pressure of 70,000 lb is available.

**BLAST HOLE DRILL STATISTICS**
**EAGLE MOUNTAIN MINE**

| Type of Machine | Rock Hardness | Hole Size | Hole Spacing | Row Spacing | Ft per Hour | Ft per Bit | Cost per Ft | Men per Crew |
|---|---|---|---|---|---|---|---|---|
| Bucyrus Erie 29 T Churn Drill | Soft to Med. Hard | 9" | 12'-15' | 15' | 5 | 1000 | $2.25 | 2 |
| Bucyrus Erie 42 T Churn Drill | Soft to Med. Hard | 9" | 12'-15' | 18' | 10 | 1500 | $1.65 | 2 |
| Bucyrus Erie 50 R Rotary | Soft to Med. Hard | 9⅞" | 15'-18' | 18' | 40 | 400 | $0.90 | 2 |
| Ingersoll-Rand Drillmaster | Hard | 6" | 12' | 12' | 16 | 1910 | $1.14 | 2 |

**NOTE:** Only direct operating costs included in costs per ft. Figures are based on actual performance and no adjustment has been made for variation in rock types.

These two features are important at Eagle Mountain because the drilling conditions vary so widely.

Previous to this time, in other mines, this type of machine had done an excellent job of drilling softer material but it had never been used for drilling material as hard as that which is found at Eagle Mountain. At the time of purchase, the five of these machines which were in operation were working at various coal mines and limestone quarries.

The 50 R is electrically operated and uses a power supply of 60 cycles, 4160 volts. Power is supplied to the machine by a type S.H.D., three conductor trailing cable which in turn takes its power through a skid mounted safety-breaker box. The machine is crawler mounted and can easily move about the Eagle Mountain pit.

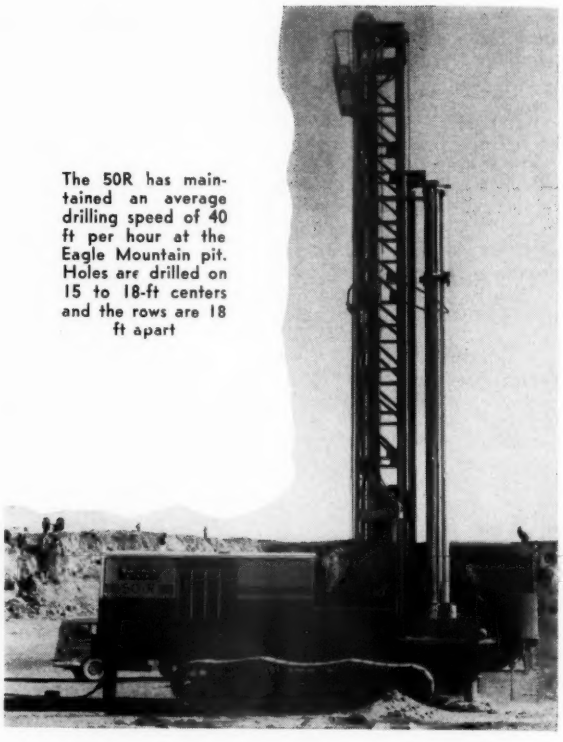
Nine and seven eighth-in. Hughes Tri-Cone Rotary bits are used. Air is fed through the drill pipe at 80 lb pressure and is discharged at the bit. This serves to cool the bit and remove the drill cuttings from the hole. All holes are drilled to a depth of ten ft below the required bench elevation. About two ft of hole cannot be cleaned so a total of 38 ft of hole is actually available for loading. Holes are drilled on 15 to 18 ft centers and the rows are 18 ft apart.

When the machine was first delivered, all of the drilling was done on a dry basis and the dust was collected by a "Rotoclone" type dust collector. However, this system was not successful in controlling the dust.

Modern drilling methods and equipment are used at the Eagle Mountain Mine to produce a daily average of 10,000 tons of ore and 20,000 tons of waste

After a short period of operation the dust collector was removed and a water pump was installed so that water could be introduced into the air stream for control. This system not only controls the dust but also serves to "mud" the wall of the hole. As a result, hole caving and bit sticking have been reduced and drilling speed increased.

The 50 R has maintained an average drilling speed of 40 ft per hour with an average bit life of 400 ft. As mentioned above, the original estimated performance was 21 ft per hour with 460 ft of bit life. The 42 T churn drills were able to average ten ft per hour when drilling the same material. The increased drilling speed has been coupled with a reduction of 45.4 percent in drilling costs.

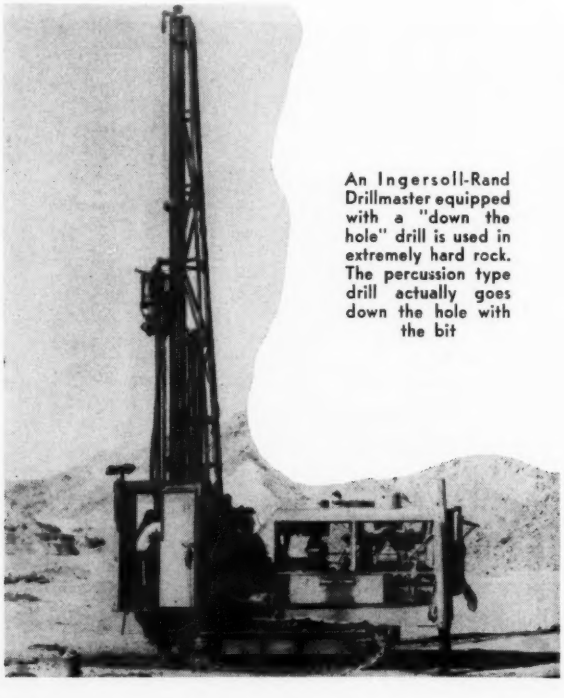


The 50R has maintained an average drilling speed of 40 ft per hour at the Eagle Mountain pit. Holes are drilled on 15 to 18-ft centers and the rows are 18 ft apart

## "Down-the-Hole" Drill for Hard Rock

In spite of its good performance when used in soft to medium hard material, the rotary drill does not perform well when it is used in the very hard material which constitutes about 15 to 20 percent of the total. In this material, the bit life is reduced to about 85 ft per bit with a drilling rate reduced to ten ft per hour.

After a study of various methods of improving our hard rock drilling practice, an Ingersoll Rand Drillmaster equipped with a "down the hole" drill was put to work at Eagle Mountain in September 1955. This machine incorporates some rather new and different ideas in drill design. The percussion type drill actually goes down the hole with the bit and it receives its operating air through the hollow drill rod. The bit diameter is larger than the drill shell and this enables the drill to follow the bit down the hole. The bit is held in the drill by means of a retaining ring which permits restricted bit movement in and out of the front head. The full power of the drill is thus transferred directly to the bit and no power is wasted in transmitting hammer blows through rods, couplings and joints. A rotary air motor turns the entire assembly of rods, drill and bit. Continuous hole cleaning is accomplished by directing high pressure air through the drill and the bit. Additional hole cleaning comes from the drill exhaust, resulting in efficient use of each cubic foot of air.



An Ingersoll-Rand Drillmaster equipped with a "down the hole" drill is used in extremely hard rock. The percussion type drill actually goes down the hole with the bit

Like the rotary drill, the Drillmaster was originally equipped with a dry dust collector. However, this did not give satisfactory results and it was necessary to remove the dust collector and introduce water into the air stream in order to control the dust and "mud" the wall of the hole for increased drilling speed.

Tungsten carbide bits which are sharpened in the field are used. Six-in. holes are drilled on 12 ft centers and 12 ft row spacing.

*(Continued on page 50)*

# Maintenance—

# A TOOL FOR INCREASED PRODUCTION

By C. N. VAN HOUTEN
**Superintendent-Maintenance**
**Coal Mines Works**
**Tennessee Coal & Iron Division**
**United States Steel Corp.**

ONE of the most outstanding achievements of the industrial age in which we are now living has been the mechanization of the mines of this country. The tremendous job which has been accomplished in this basic industry in such a relatively short period of time is not too well known. However, we who have grown up through this great change are very well aware of it. Also, we are very well aware that if this nation of ours is to continue in its proper place in the world, we will be called upon in the future to produce at rates which today may seem fantastic.

As we continue to strive for ever increasing production the obvious demand for higher capacity machines makes itself felt. As equipment manufacturers respond to this demand for greater capacity, we find ourselves caught with other problems to be solved. Electrical units must produce more horsepower, hydraulic units must handle higher pressures and volumes, and pneumatic units must generate increased outputs with no increase in temperatures. All this must be accomplished with no appreciable or comparable increase in size because in the mines limited vertical and lateral clearances will be with us always. Safety of personnel must be considered. Heavier and faster moving equipment coming into the mines increases safety hazards. Roof control is further complicated by the rapid advance of faces. Consideration of safety has accompanied and must guide progress in mining equipment.

All of us have felt the consequences of this trend. Technically, machines are getting more complicated every day; delays to production increase because of the inaccessability of critical components; spare parts are more expensive; the machines are getting more difficult to overhaul. If we are to operate these modern machines efficiently, it is only logical to assume that we will have to adopt a more modern maintenance program. No piece of equipment can be expected to operate very long without proper maintenance.

On this premise, maintenance has emerged as a key member of the production team. The maintenance organization whose role is based upon routine and breakdown repairs alone is as out of date as the pick and shovel miner. Part time maintenance is out of the picture. Instead, the progressive maintenance organization must devote all of its energies, skills, efforts and imagination toward the common goal of greater productivity through a well-planned and organized maintenance program.

Tennessee Coal & Iron Division, an integrated steel operation of United States Steel Corp., has very extensive works in and around Birmingham, Ala. This area has been often referred to as a geologist's paradise because the raw materials for steel production have been developed in sufficient quantity within a radius of a few miles. Coal for coke comes from the Division's coal mines, metallics from its iron ore mines and flux from its quarry. All of these mines and the quarry are within a few miles of the steel mills.

TCI's mines have been mechanized, the same as many others in the country, to meet increased demands for greater economy. Likewise, we have been faced with the same maintenance problems as other mines. We have tried many approaches to these problems and this article is a report of what we are doing at present.

No claim is made that what we are doing is the one and only solution for the maintenance problem. It is what we feel is best for our own situation at present. A maintenance program must be adapted to the particular needs of an individual operation. The size and expected life of a mine, the number of mines, the type of mining, the type of material mined, the type of equipment currently in use, and even the location of a mine are only a few of the things which will have an effect on the program to be adopted. In fact, even though the general overall maintenance program of both the ore mines and the coal mines is the same, there exist some differences in details between the two.

## Sectional Repairs

Repairmen are assigned to each operating section on each operating shift. Although these men report directly to the underground maintenance foreman, they stay in the section and work closely with the section foreman and crew. Their duties are mostly to inspect equipment and to make minor repairs and adjustments as they occur during the shift. They do their work at times when the equipment is idle or can be stopped with least interruption to production. The maintenance foreman makes periodic visits to each section to consult with repairmen and to check on the quality of their work. A limited supply of spare parts is kept in each section. These repairmen are equipped with a good complement of tools. Sectional repairmen are familiar with the capabilities of each piece of equipment and are very valuable in training opera-

**Following are the important phases of the general maintenance program at TCI mines:**

1. Provide personnel on each operating section to take care of minor repairs and adjustments.
2. Provide underground shops to take care of heavier repair and to maintain miscellaneous equipment throughout the mine.
3. Provide a sufficient number of spare operating sections to permit scheduled shutdowns of regular operating sections for general repairs. Included in this plan is a specially equipped crew to make the repairs.
4. Provide surface shops for maintenance of surface facilities and for complete overhaul of component sub-assemblies and entire machines.
5. Provide other miscellaneous services which will reduce delays to a minimum.

tors. This applies to both ore and coal mines.

In the ore mines because move ups of sectional loading points are made every three or four months, adequately equipped repair shops are maintained in a well prepared and well lighted area in each section. Much hard surfacing of parts worn by abrasion as well as routine repairs to parts and sub-assemblies is done during the operating shifts. Furthermore, all equipment is moved into this general area for repair during the periods of regular scheduled maintenance.

### Underground Repair Shops

At each mine there is an underground repair shop where heavier repairs are made. In these shops are such facilities as an overhead traveling crane, electric welding and acetylene burning equipment, drill presses, portable and stationary grinding equipment, and in some shops a steam cleaner is provided. A substantial supply of spare parts, spare motors and sub-assemblies is kept at these shops.

The size of the shop crew varies with the size of the operation and number of shifts operated. In some of the shops there is a maintenance clerk on one shift who has charge of keeping time and records, issuing supplies, spare parts and special tools, and maintaining an adequate inventory. Each member of the underground repair shop crew has been issued a set of tools and is provided a locker in which to keep them. Only the individual and the foreman have a key to each locker.

In this shop, retrucking of locomotives is usually performed, as well as replacement of sub-assemblies too big to be handled in the sections. Other work handled out of this shop is installation, extension and repair of trolley wire, signal and telephone wires; maintenance of underground motor generators and rectifiers; welding of track; and lubrication of locomotives.

### Spare Operating Sections

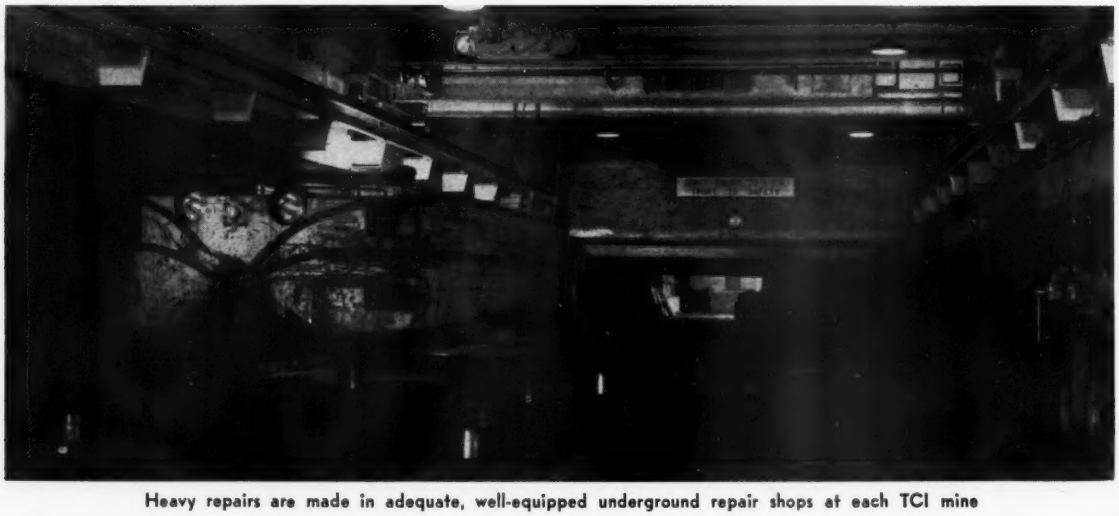
To make sure of a steady flow of raw materials to the blast furnaces, each mine has a sufficient number of fully-equipped spare sections to permit regular operating sections to be shut down for general repairs. A spare section is provided for each four to eight operating sections. A definite schedule is made which rotates each sectional crew, after a designated number of operating shifts, through the spare section for a definite period to allow the repair crew time to do the necessary maintenance. The sectional crew then returns to its regular section and the next scheduled crew moves into the spare section. This is a continuing program and is closely followed.

A special crew led by a maintenance foreman is assigned to this rotating general repair in operating sections. It is fully equipped with tools and accessory repair devices.

In the case of the coal mines for reason of safety regulations, a regular preshift examination is made before the repair crew enters a section, and there is always a certified person assigned to the crew.

Sectional repairmen keep the maintenance foreman informed of the condition of their equipment and give him a general line up of special work which will have to be done. Thus, when the general repair crew goes to a section, they know what special work will have to be done other than general repairs and checking conditions of equipment, and take along the necessary spare parts and sub-assemblies, as well as any special tools that may be needed.

In addition to the spare section, we have a limited number of extra loaders, shuttle cars and other complementary equipment. Quite often, instead of changing out a sub-assembly or performing extensive repair work, the repair crew may change out the entire machine with one of the spare units. The unit removed from service is then sent to either the un-



Heavy repairs are made in adequate, well-equipped underground repair shops at each TCI mine

Steam cleaning a stoper prior to repairing it

The general repair crew works on a leading machine

derground or the surface shop to be put back in good operating condition.

When an operating crew moves to the spare section, the sectional repairman and the section foreman remain in their own section. This means that the spare section has its own repairman and foreman. By following this practice, sectional repairmen are of invaluable aid to the general repair crew. Another aspect we consider to be of value is that, by participating in more detailed repair work of a piece of equipment, sectional repairmen learn more about it.

Maintenance was given a real opportunity when the Tennessee Coal & Iron Division adopted the policy of providing spare sections and extra machines for overhaul. What we strive to do is to make repairs so complete that the equipment will operate without interruption from one scheduled idle period to the next.

## Surface Repair Shops

Backing up the underground maintenance forces are well-equipped and well-manned surface shops where subassemblies and entire machines are repaired and overhauled. These shops are responsible for maintenance of all surface facilities such as fans, hoists, and surface electrical facilities. It is here too, that mine cars are repaired and most modification of equipment is done.

The ore mines have one large central repair shop for all of their mines. It is so fully equipped with various pieces of machinery that practically every type of required repair work can be performed there.

The coal mines have a surface repair shop at each of the five mines, where most repair and overhaul work is done. When there is a job beyond the facilities of these shops, it is sent to the division's steel mill shops at Ensley and Fairfield.

All armature winding and similar electrical work for both ore and coal mines is handled by the electrical shops at the steel plant.

## Miscellaneous Services

**Records.** The foundation and primary prerequisite to a modern maintenance program is complete, accurate and usable records. These records may consist of anything from a simple mimeographed form to a coded key punch card fed to an electronic computer. The form used should serve one purpose only—to tell the maintenance people how their program is working. Having this information, they will then know which way to direct their efforts. No record should be kept just for the sake of having a record. If it is not studied objectively, and if we cannot learn from it how to get our machinery to operate longer, with fewer breakdowns and at a reasonable cost, then the record is of very little value.

At all of our mines, section foremen report delays on all equipment, indicating whether they were due to breakdown or other causes. This information is gathered by the accounting department, tabulated and translated into cost figures for such delays. As a further service, the accounting department consults with operating and maintenance people and makes an analysis of the delays, as well as all repair and maintenance costs. From this information, maintenance people start studying the problem to determine what machine, what sub-assembly or what part is causing the trouble. Also, information gained from these records and analyses frequently leads to trial of substitute commodities and materials which offer superior performance at a reduced cost.

A practice recently begun requires that repairmen prepare a job sheet showing a distribution of their time. In addition to showing the time spent on repairing and inspecting a piece of equipment, they show, also, the spare parts used. This information is then transferred to a visual card record where time and material are shown, not only for individual machines, but also for principal sub-assemblies. Shown on this record is the scheduled time for overhaul of major pieces of equipment. As this program is expanded it is planned to put the information on coded key punch cards, which were previously mentioned.

**Overhaul and Replacement of Equipment.** In the overhaul program, all major pieces of equipment are scheduled for a complete overhaul in the surface shops. This schedule is set up on the basis of tons of material handled, time in operation or some other similar yardstick. The ore mines department has extended this program further and is changing out and overhauling some sub-assemblies on the same basis.

At TCI it is recognized that even though a piece of equipment such as a loader, shuttle car, locomotive, cutting machine, drill machine and a mobile air compressor may be overhauled and put back in very good condition, there comes a time when it should be replaced. Therefore, there is set up a retirement program for this type of equipment, based on its expected economical life. This permits us to get full benefit from the equipment we purchase and then to replace it with another of more modern design and usually of greater capacity.

**Spare Parts.** In any maintenance program it is absolutely necessary to maintain an adequate supply of spare parts. The primary problem here is the determination of what constitutes an adequate supply. If there is not adequate control, deadlined equipment may be idle for extended periods of time waiting for a spare part. On the other hand there may be a large capital investment in an overly large

stock, much of which may have to be scrapped when a particular type of equipment is taken out of service.

We try to keep this phase under reasonable control by having a special committee which studies and checks our supply of spare parts and sub-assemblies. On this committee are representatives of the operating, accounting, stores and maintenance departments.

**Training of Maintenance Personnel.** With the mechanization of our mines, we have been confronted with the problem of having properly trained maintenance personnel. We have found that if the maintenance program is to be successful, we must train men within our organization.

We have tried many approaches and each has been effective to some degree. Our present program is the most effective one that we have tried. Selected groups of personnel voluntarily attend a company-sponsored maintenance school one day each week. A full-time instructor is employed to teach this course. The students receive a full day's pay for attending classes, but they are required to pay, through a payroll deduction plan, for special text material prepared and furnished by a correspondence school. At the successful completion of the course, half of the amount paid by the students is refunded by the company.

**Miscellaneous Sub-Programs and Services.** Within the activities of the maintenance department there are untold fields for increasing production and for reducing cost. The application of modern repair techniques has much to offer.

For example, the use of "heli-coil" thread repair kits in overhaul shops and in the spare section repair program can save many man-hours of labor as well as return to better than new, worn or damaged parts.

The effective use of hard-surfacing welding techniques increases many times the life of components exposed to abrasion.

The proper use of metallizing techniques can reclaim many previously scrapped parts. In some instances the metallized part will demonstrate a greater service factor than the new part, due to the range of selectivity for surface to be applied. An example of this improved service is a hydraulic cylinder jack piston. When the mild steel piston or ram becomes scored, it is reworked by using a stainless steel surface material which is impregnated with micro-crystalline wax. The stainless steel wears about three times longer than the original surface. The wax makes the new surface self-lubricating. Packing glands last about four to five times longer. Recent experience in this field will allow us to change present specifications when ordering parts and new equipment.

Another ripe field for reducing costs of maintenance is in jigs and fixtures for our general purpose machine tools in the shop. To cite two examples: A gear case costing many hundreds of dollars can be reworked and line-bored for less than one-tenth the replacement cost; an idler sprocket can be rebuilt and jig-bored for less than one-fifth the replacement cost.

Recently installed on each section in the coal mines, to facilitate lubrication of equipment, was a portable power "grease wagon" using a tank of compressed nitrogen as the expellent force. Nitrogen is used because of being an inert gas and economically priced. This project has been very successful.

For several years we have been oxy-acetylene welding main line track. In addition to having safer and more efficient haulageways, there have been substantial savings in installation and maintenance costs. Another important advantage we have found is that power is improved throughout the mine. In fact, at one of the ore mines, power was so improved after welding track that it was not necessary to install a 300 kw conversion unit originally planned for that mine.

Available to the mines are special services of the steel mill shops. They have equipment for making any kind of test we may need. For instance, when we change out hoist ropes, a typical section of the old rope is cut out and tested. From this kind of information, we have learned much about the life of our ropes. The Department of Metallurgy, Inspection and Research has facilities for determining the metallurgical characteristics and strength of metals in equipment we use. Another department that has given us excellent service is the Electrical Laboratory, which can make tests on the simplest of electrical equipment as well as very complicated electronic devices.

With the excellent cooperation of the different departments in TCI many improvements have been made on mining equipment. These improvements developed in our shops have been largely incorporated on new equipment by the manufacturers.

## Conclusion

Any maintenance program is just so many words unless there is a vigorous and spirited organization to back it up. This applies to operating personnel as well as to maintenance people. In our mines we have such a group.

Of course, we at TCI are the first to admit that our program is far from perfection. There are still many things to be done. We are fully aware of this fact and will continue to search for better ways to make our maintenance a real tool for increased production.

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**EAGLE MOUNTAIN MINE**

*(Continued from page 46)*

During the past year the Drillmaster has maintained an average drilling rate of 16 ft per hour and an average bit life of 1910 ft. For purpose of comparison, it might be interesting to note that in the same formation the 42 T churn drill drilled at a rate of only two ft per hour and the rotary drill at a rate of only ten ft per hour.

In summation of the foregoing, it should be noted that after considering all of the applicable methods of blast hole drilling, we have, for the time being, settled upon a drilling practice in which a Bucyrus Erie Model 50 R rotary drill is used in soft to medium hard rock, and an Ingersoll Rand "down the hole" drill in extremely hard rock. At Eagle Mountain Mine these two machines are not competitive, as they are used in different types of rock and each has done its job well. At present two 50 R machines, one of which has just been delivered, and one Drillmaster are being operated. These machines have completely replaced the churn drills and they are able to do all of the blast hole drilling for our present production requirement, which is 50 percent more than the tonnage formerly drilled by six 42 T's.

## Secondary Drilling Equipment

In addition to the primary drilling equipment there are at least two other interesting machines being used at Eagle Mountain. The first is a Gardner Denver "AirTrac" Drill, which is essentially a large drifter mounted upon a self propelled, air operated, caterpillar type carriage. It drills a three-in. hole and has done a good job of pioneering benches, building road cuts, etc.

The second is a "Travel Drill" which is manufactured by the Travel Drill Corp. of Raleigh, N. C. The machine is a rubber tired, self-propelled unit equipped with an air compressor and a fully articulate boom upon which is mounted a movable cab and standard drifter. All controls, including travel, are mounted in the cab and one man can comfortably and safely drill boulders at heights of up to 28 ft above the pit floor. By this means, the danger and drudgery have been eliminated from our secondary drilling.

Primary drilling at Eagle Mountain is a difficult job. The best and most modern equipment has been obtained for each type of work. However, we are always looking for better ways of doing the job and as improved equipment is developed it will certainly be considered.

# AMC CONVENTION

# SALT LAKE CITY

## Utah's capital is host for the 1957 Metal Mining and Industrial Minerals Convention of the American Mining Congress

SALT LAKE CITY will welcome some 2000 mining men and their ladies from all parts of the country September 9-12 as they gather for the big mining event of the year. Final arrangements for this national meeting have been made under the direction of L. F. Pett, general manager, Utah Copper Division, Kennecott Copper Corp., General Chairman for the Convention. Even a cursory examination of this special preview will reveal the wide scope of the problems to be discussed and the gala entertainment in store for Mr. and Mrs. Convention Delegate.

The Program Committee, headed by Chairman A. H. Shoemaker of Homestake Mining Co., has developed a comprehensive program that deals with Government-industry relationships and the solutions to major operating and economic problems. Top mining men, industrialists and Government officials will rub elbows and exchange information at this meeting, bringing to each a greater awareness of the other's problems.

Members of Congress interested in the problems of domestic mining who are scheduled to address the meeting include: Senators Arthur Watkins of Utah, Karl Mundt of South Dakota, Alan Bible of Nevada, and Frank A. Barrett of Wyoming; Congressmen Ed Edmondson of Oklahoma, Henry A. Dixon and William A. Dawson of Utah, John J. Rhodes of Arizona, Richard M. Simpson of Pennsylvania, and Frank Ikard of Texas. Other Government officials on the program include: Victor E. Cooley, Deputy Director, Office of Defense Mobilization; Governor George D. Clyde of Utah; Salt Lake City's Mayor Adiel F. Stewart; Edward Woozley, Director, Bureau of Land Management; Allen F. Miller, U. S. Forest Service; James Westfield, Asst. Director, Health and Safety, U. S. Bureau of Mines; Robert E. Flinn, Chief, Division of Health, U. S. Bureau of Mines; and Henry N. Doyle, Asst. Chief, Occupational Health Program, U. S. Public Health Service.

The Newhouse Hotel will be the scene of the various Convention sessions. Addresses have been scheduled on national mineral policies; labor relations and management problems; the state of the mining industries; public land matters; safety and health; mineral taxation; gold, silver and monetary problems; developments in industrial minerals; the future of uranium, and special questions relating to the strategic mineral industries.

Operating and production problems will be fully discussed. Topnotch mining engineers and operating men, geologists and metallurgists will cover latest underground and open-pit methods and equipment, exploration and geology, and a wide range of topics in mineral dressing and metallurgical research. A special session will be devoted to industrial engineering and modern management techniques.

A session on uranium will emphasize new mining developments and the world outlook for nuclear applications.

A total of 18 sessions will be held during the Convention. The full agenda, together with the names of the speakers, is presented on pages 55 to 59. A careful study of the program will help to make the time spent in the meeting rooms pay big dividends.

### DRAFT DECLARATION OF POLICY

One of the important products of the American Mining Congress Convention will be the Declaration of Policy, setting forth the mining industry's views on matters of national import. This will be drawn up by the Resolutions Committee, headed by Kenneth C. Kellar, attorney, Lead, S. D., and including in its membership leaders in all branches of the mining industry from all sections of the country. Twelve subcommittees have been named to give advance consideration to topics of major importance.

The entire Resolutions Committee will meet in Salt Lake City on September 7 and 8 to whip the policy declarations into final shape for submission to the Convention. Its report will be presented in sections at appropriate points during the sessions, thus affording an opportunity for careful consideration, and making it possible to give full publicity to the industry's position on public questions.

### FUN AND RELAXATION

The chief purpose of these annual conventions is the serious consideration of mining's problems and the exchange of operating information and ideas within the industry. But the fun and relaxation for which these meetings are famous have not been neglected.

Salt Lake City—with its magnificent scenery, historical spots and fine entertainment facilities—offers convention-goers much to do and see. In addition, a number of special entertainment functions have been scheduled to make this meeting one to be long remembered.

To start the Convention off right, a Welcoming Luncheon for mining men and their ladies has been arranged for Monday noon at the Rainbow Randevu. An interesting and timely address will be given by a prominent national figure.

On Monday night a "Miners Jamboree" will be held at Saltair, the world-famous amusement park on the shore of Great Salt Lake. Dinner, dancing and special entertainment will be featured. Kennecott Copper Corporation will be host on Tuesday night at a special party on the 6190 level of the Utah Copper open pit at Bingham Canyon.

*(Continued next page)*

Climax of the Convention will be the Annual Banquet at the Rainbow Randevu. "Speechless" as always, there will be music and dancing as well as good food and refreshments. The star-studded entertainment program will be full of surprises and packed with talent. Don't miss this big event.

### LADIES' OWN PROGRAM

As always, the ladies are cordially invited to attend all Convention functions and to go on all the trips—and in addition a series of special events has been arranged just for them.

On Tuesday a luncheon will be held at the University of Utah's beautiful new Union Building, followed by a preview of fall and winter fashions.

On Wednesday the ladies will enjoy a delicious "brunch" in the scenic atmosphere of the Fort Douglas Golf Club and the Salt Lake Country Club. This will be followed by a special organ recital by Alexander Schreiner at the famous Mormon Tabernacle.

Ladies' Headquarters will be on the Mezzanine Floor of the Hotel Utah beginning Sunday, September 8, and coffee will be served there each morning.

### TWO FIELD TRIPS ARRANGED

Also of special interest to Convention visitors will be the trips to nearby mining and industrial operations that have been arranged for Thursday, following the Convention sessions.

One trip, leaving at 8:15 a. m., will tour the Geneva Steel Plant of Columbia-Geneva Steel Division, United States Steel Corp., near Provo. This visit to the West's largest integrated steel operation will include the blast furnaces, open hearths and the rolling mills where steel plates, coils, hot sheets and structural shapes of all sizes are rolled. The party will return to Salt Lake City about 3:00 p. m.

On the second trip, also leaving at 8:15 a. m., a number of mining and metallurgical plants will be viewed. Stops on this "circle tour" will be made at the modern surface plant of U. S. Smelting's U. S. and Lark Mines, a major producer of lead and zinc; Kennecott's Magna mill which, together with the adjoining Arthur plant, handle approximately 25 percent of the total U. S. copper ore production; and the $38,000,000 Utah Power & Light Company's Garsby plant, the area's largest steam electric station. En route the party will have an opportunity to see Salt Lake Tungsten's refinery, Vitro Uranium Company's mill, the Hercules Powder plant at Bacchus, Kennecott's electrolytic copper refinery, the Garfield copper smelter of American Smelting & Refining Co., the cobalt refinery of Calera Mining Co., the Western Phosphate plant, and the Saltair plant of Morton Salt Co. Return to Salt Lake City will be about 4 p. m.

Individuals or small groups wishing to visit any of the plants at which special stops are not made on the "circle tour" can make arrangements through the Trips Committee at the time of the Convention.

Morrison-Knudson's Southern Pacific

*(Continued on page 59)*

# WESTERN DIVISION

## THE AMERICAN MINING CONGRESS

**L. F. PETT, Chairman**
**General Manager, Utah Copper Division**
**Kennecott Copper Corporation**

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R. R. WILLIAMS, JR., Mgr., Mng. Dept., Colorado Fuel & Iron Corp.
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S. H. WILLISTON, Vice Pres., Cordero Mining Co.
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WALLACE G. WOOLF, Gen Mgr., The Bunker Hill Co.

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Senator from
South Dakota

# Convention Program

## MONDAY

*September 9*

(All events, except as noted, will be held in the Newhouse Hotel)

**8:30 A.M.** Registration—Lobby, Newhouse Hotel

**9:25 A.M.** Pre-Session Motion Picture—
"Utah-Arizona National Parks"
(Union Pacific Railroad Co.)

**9:45 A.M.** OPENING SESSION

Chairman: HOWARD I. YOUNG, *Pres.*, American Zinc, Lead & Smelting Co., St. Louis

What Are Our National Mineral Policies?
Representative of Department of the Interior
HON. VICTOR E. COOLEY, *Deputy Director*, Office of Defense Mobilization
HON. ARTHUR V. WATKINS, *U. S. Senator from Utah; Member*, Senate Interior Committee
HON. ED EDMONDSON, *U. S. Representative from Oklahoma; Member*, House Interior Committee

Resolutions Committee Reports:
General Policy
Government Reorganization

**12:15 P.M.** WELCOMING LUNCHEON—
Rainbow Randevu

Presiding: L. F. PETT, *Gen. Mgr.* Utah Copper Div., Kennecott Copper Corp.; Chairman, Western Division, American Mining Congress

Welcome to Utah:
HON. GRANT M. BURBIDGE, *Commissioner*, Salt Lake City Water Supply & Water Works

Responses
HOWARD I. YOUNG, *Pres.*, American Zinc, Lead and Smelting Co., St. Louis; *President*, American Mining Congress
A. H. SHOEMAKER, *Gen. Mgr.*, Homestake Mining Co., Lead, S. Dak.; *National Chairman*, Program Committee
J. E. M. WILSON, *Vice Pres.*, Jeffrey Manufacturing Co., Columbus, Ohio; *Chairman*, Manufacturers Division, American Mining Congress
L. C. CAMPBELL, *Vice Pres.*, Eastern Gas & Fuel Associates, Pittsburgh; *Chairman*, Coal Division, American Mining Congress

Introduction of Distinguished Guests

Address: HON. GEORGE DEWEY CLYDE, *Governor of Utah*

**1:40 P.M.** Pre-Session Motion Picture
"Oklahoma" (U. S. Bureau of Mines)

**2:00 P.M.** LABOR RELATIONS

Chairman: CHESTER H. STEELE, *Vice Pres.*, Western Operations, The Anaconda Co., Butte, Mont.

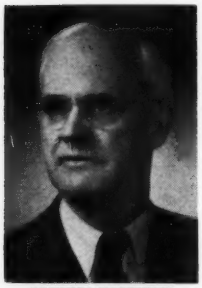
Labor Rackets and Their Meaning
HON. KARL E. MUNDT, *U. S. Senator from South Dakota; Member*, Senate Select Committee on Improper Activities in Labor and Management fields

The Right to Work
To be announced

The Kohler Strike
HERBERT V. KOHLER, *Pres.*, Kohler Co., Kohler, Wis.

Resolutions Committee Reports:
Labor Relations
Social Security
Mine Safety

*(Continued next page)*



ARTHUR WATKINS
Senator from Utah

WM. A. DAWSON
Congressman from Utah

H. A. DIXON
Congressman from Utah

ED EDMONDSON
Congressman from Oklahoma

*(Continued from previous page)*

**1:40 P.M. Pre-Session Motion Picture**
"In The Beginning"—the story of the Grand Canyon

## 2:00 P.M. EXPLORATION AND GEOLOGY

**Chairman:** EVAN JUST, *Vice Pres.*, Cyprus Mines Corp., New York

**General Remarks on Exploration**
EVAN JUST, *Vice Pres.*, Cyprus Mines Corp., New York

**Organizing for Mineral Exploration**
JAMES P. POLLOCK, *Chief Geol.*, Calumet & Hecla, Inc., Calumet, Mich.

**Geophysics in the Mineral Industry**
KENNETH L. COOK, *Head*, Dept. of Geophysics, University of Utah, Salt Lake City

**Mining Photogeology**
THOMAS W. MITCHAM, *Mining Geologist-Consultant*, Flagstaff, Ariz.

**Rotary Drilling and Sampling**
E. P. CHAPMAN, JR., Chapman, Wood & Griswold, Albuquerque, N. Mex.

**1:40 P.M. Pre-Session Motion Picture**
"Metallurgy Plus"

## 2:00 P.M. MILLING AND METALLURGY

**Chairman:** E. H. CRABTREE, *Director*, Colorado School of Mines Research Foundation, Inc., Golden, Colo.

**Development and Use of Cyclones at Chuquicamata**
D. S. SANDERS, *Concentrator Supt.*, Chile Exploration Co., Chuquicamata, Chile

**Liquid-Liquid Extraction for the Recovery of Uranium**
J. BRUCE CLEMMER, *Chief*, Div. of Mineral Technology, U. S. Bureau of Mines, Salt Lake City

**Behavior of Metals Other Than Uranium in Liquid-Liquid Extraction Processes**
C. J. LEWIS, *Mgr.*, Chemical Div., and E. H. CRABTREE, *Director*, Colorado School of Mines Research Foundation, Inc., Golden, Colo.

**Advantages of Making Uranium Fluoride in Uranium Mills**
R. S. LONG, Research Dept., Dow Chemical Co., Pittsburg, Calif.

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**6:00 P.M. MINERS JAMBOREE at Saltair**
**Buses leave Newhouse and Utah Hotels beginning 6 P.M.**

# TUESDAY

## *September 10*

**8:30 A.M. Registration—Lobby, Newhouse Hotel**

* * *

**9:10 A.M. Pre-Session Motion Pitcure—**
"Horizon Unlimited" — the Navy's Viking Rocket

## 9:30 A.M. STATE OF THE MINING INDUSTRIES

**Chairman:** EDWARD H. SNYDER, *Pres.*, Combined Metals Reduction Co., Salt Lake City

**Copper**—J. B. PULLEN, *Asst. Gen. Mgr.*, Phelps Dodge Corp., Douglas, Ariz.

**Lead-Zinc**—CHARLES E. SCHWAB, The Bunker Hill Co., Kellogg, Idaho; *Chairman*, Emergency Lead-Zinc Committee

**Iron Ore**—RUSSELL C. FISH, *Vice Pres.-Operations*, Hanna Coal and Ore Corp., Cleveland

**Light Metals**—STANLEY B. WHITE, *Vice Pres., & Gen. Mgr.*, Metals Div., Kaiser Aluminum & Chemical Corp., Oakland, Calif.

**Strategic Metals**—S. H. WILLISTON, *Vice Pres.*, Cordero Mining Co., Palo Alto, Calif.

**Industrial Minerals**—RICHARD J. LUND, *Asst. Tech. Director*, Battelle Memorial Institute, Columbus, Ohio

**Uranium**—PHILLIP L. MERRITT, *Senior Geol.*, E. J. Longyear Co., New York

**Resolutions Committee Reports:**
Long Range Minerals Policies
Solid Fuels
Uranium

**9:10 A.M. Pre-Session Motion Picture—**
"The Copper Network" (U. S. Bureau of Mines)

## 9:30 A.M. UNDERGROUND MINING

**Chairman:** A. H. SHOEMAKER, *Gen. Mgr.*, Homestake Mining Co., Lead, S. Dak.

**Steep Rock's Hogarth Shaft**
WALTER S. BANNISTER, *Gen. Mining Engr.*, Steep Rock Mines, Ltd., Atikokan, Ont.

**Performance of Cleveland-Cliffs' Koepe Hoist**—review of results since last year's presentation. Speaker from Cleveland-Cliffs Iron Co.

Sinking and Operation of Circular Shafts
W. Z. WENNEBORG, *Mine Engr.*, Intermountain Chemical Co., Green River, Wyo.

Application of the Cryderman Machine in Inclined Shafts
T. M. TOWER, *Supt.*, and C. J. WARD, *Asst. Supt.*, Page Mine, American Smelting & Refining Co., Wallace, Idaho

Discussion—Vertical Shafts: JOHN BADER, *Project Engr.*, East Tintic Project, Western Mining Divs., Kennecott Copper Corp., Salt Lake City.

Planning Operations to Minimize Rock Bursts
R. G. K. MORRISON, *Chairman*, Dept. of Mining Engineering, McGill University, Montreal, Canada

**9:10 A.M. Pre-Session Motion Picture—**

"Packaged Power"—the story of bauxite mining and aluminum production

## 9:30 A.M. OPEN PIT MINING

Chairman: ALFRED T. BARR, *Mgr.*, New Cornelia Branch, Phelps Dodge Corp., Ajo, Ariz.

Drilling Taconite at Pilotac Mine
IRVING H. RUBOW, *Supt.*, Pilotac Mine, Oliver Iron Mining Div., U. S. Steel Corp., Mountain Iron, Minn.

Blasting with Ammonium Nitrate
DORT TIKKER, Inorganic Chemicals Div., Monsanto Chemical Co., St. Louis

Discussion: L. E. SNOW, *Gen. Foreman*, Drilling and Blasting Dept., Mine, Utah Copper Div., Kennecott Copper Corp., Bingham Canyon, Utah

The Little Valley Project—the new Great Salt Lake Causeway
WILLIAM M. JAEKLE, *Chief Engr.*, Southern Pacific Co., San Francisco

## 12:15 P.M. STRATEGIC MINERALS LUNCHEON
**Lafayette Ballroom, Hotel Utah**

Presiding: S. H. WILLISTON, *Vice Pres.*, Cordero Mining Co., Palo Alto, Calif.; *Chairman*, A.M.C. Strategic Minerals Committee

Guest Speaker:
HON. ALAN BIBLE, *U. S. Senator from Nevada*

**1:40 P.M. Pre-Session Motion Picture—**

"Wyoming" (U. S. Bureau of Mines)

## 2:00 P.M. PUBLIC LANDS

Chairman: HON. HENRY A. DIXON, *U. S. Representative from Utah*

Are Further Revisions of Our Land Laws in the Offing?
HON. FRANK A. BARRETT, *U. S. Senator from Wyoming*

An Industry View of the Mining Laws and Their Operation
W. HOWARD GRAY, *Attorney-at-Law*, Ely, Nev.; *Chairman*, A.M.C. Public Lands Committee

Administration of the Multiple Use Acts
EDWARD WOOZLEY, *Director*, Bureau of Land Management
ALLEN F. MILLER, U. S. Forest Service

Have Military Land Withdrawals Been Curbed?
HON. WILLIAM A. DAWSON, *U. S. Representative from Utah*

Resolutions Committee Reports:
Public Land Policy
Water and Air Pollution
Radio Frequency Allocations

**1:40 P.M. Pre-Session Motion Picture—**

"Knowing's Not Enough" (U. S. Steel Corp.)

## 2:00 P.M. SAFETY AND HEALTH

Chairman: R. T. ELSTAD, *Pres.*, Oliver Iron Mining Div., U. S. Steel Corp., Duluth, Minn.

Panel: Cooperation of the Federal Government in Accident Prevention

Moderator: HON. JOHN J. RHODES, *U. S. Representative from Arizona*

Panel Members:

JAMES WESTFIELD, *Asst. Director*—Health and Safety, U. S. Bureau of Mines, Washington, D. C.

ROBERT E. FLINN, *Chief*, Division of Health, U. S. Bureau of Mines, Washington, D. C.

HENRY N. DOYLE, *Asst. Chief*, Occupational Health Program, U. S. Public Health Service, Washington, D. C.

E. I. RENOUARD, *Mgr. of Mines*, The Anaconda Co. Butte, Mont.

FRANKLIN G. PARDEE, *Pres.*, American Iron Ore Association, Cleveland

ORR WOODBURN, *Director*, Globe-Miami Mine & First Aid Association, Globe, Ariz.

Human Failure—A Sleeping Giant
GEORGE A. BORGESON, *Mgr., Safety & Claims*, The M. A. Hanna Company, Hibbing, Minn.

Fighting a Mine Fire With $CO_2$
F. J. HALLER, *Vice Pres.*, and F. G. MICHELS, *Safety Director*, North Range Mining Co., Negaunee, Mich.

Essentials of a Sound Mine Safety Program
J. HOWARD BIRD, *Dist. Supervisor*, U. S. Bureau of Mines, Denver

**1:40 P.M. Pre-Session Motion Picture—**

"Iron Ore Unlimited"

## 2:00 P.M. MILLING AND METALLURGY

Chairman: NORMAN WEISS, *Milling Engr.*, American Smelting and Refining Co., Salt Lake City

Applications of the New Dutch State Mines Screen
PAUL L. STAVENGER and VICTOR R. REYNOLDS, Centrifugal Technical Div., Dorr-Oliver, Inc., Stamford, Conn.

Bacterial Leaching of Manganese Ores
E. C. PERKINS, *Supervisory Metallurgist*, Electrometallurgical Experiment Station, U. S. Bureau of Mines, Boulder City, Nev.

Solar Furnace for Metallurgical Research
W. M. TUDDENHAM and R. E. LEWIS, Kennecott Research Center, Western Mining Divs., Kennecott Copper Corp., Salt Lake City

Research in the Direct Reduction of Iron Ore
H. S. TURNER, *Vice Pres.*, Research & Development, Jones & Laughlin Steel Corp., Pittsburgh

Marcona Conveyor Belt Sampler
A. H. BLYTH, *Mech. Engr.*, Marcona Mining Co., San Juan, Peru, and EARL C. HERKENHOFF, *Dir. of Research*, Utah Construction Co. San Francisco

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**6:00 P.M. "KENNECOTT PARTY" at Bingham Canyon. Buses leave Newhouse and Utah Hotels at 6 P.M. No parking space for private cars available at Bingham Canyon.**

*(Continued next page)*

**FRANK IKARD**
Congressman from Texas

**JOHN J. RHODES**
Congressman from Arizona

**R. M. SIMPSON**
Congressman from Pennsylvania

**EDWARD WOOZLEY**
Director
Bureau of Land Management

*(Continued from previous page)*

# WEDNESDAY

## *September 11*

**8:30 A.M. Registration—Lobby, Newhouse Hotel**

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**9:10 A.M. Pre-Session Motion Picture**
"Oregon" (U. S. Bureau of Mines)

**9:30 A.M. TAX PANEL**

Chairman: L. J. RANDALL, *Pres.*, Hecla Mining Co., Wallace, Idaho

HON. RICHARD M. SIMPSON, *U. S. Representative from Pennsylvania; Member*, House Ways and Means Committee

HON. FRANK IKARD, *U. S. Representative from Texas; Member*, House Ways and Means Committee

HENRY B. FERNALD, Loomis Suffern & Fernald, New York; *Chairman*, Tax Committee, A.M.C.

ELLSWORTH C. ALVORD, Alvord & Alvord, Washington, D. C.; Tax Counsel, A.M.C.

Resolutions Committee Reports:
Taxation and Government Expenditures
Mine Financing

**10:45 A.M. GOLD, SILVER AND MONETARY POLICIES**

Co-Chairmen:

DONALD H. MCLAUGHLIN, *Pres.*, Homestake Mining Co., San Francisco; *Chairman*, Gold Producers Committee, A.M.C.

FRANK A. WARDLAW, JR., *Gen. Mgr.*, International Smelting & Refining Co., Salt Lake City

Debasement of Gold by U. S. Monetary Policy
FRANZ PICK, Publisher, Pick's World Currency Report, New York

The Future of Silver
L. J. RANDALL, *Pres.*, Hecla Mining Co., Wallace, Idaho

Resolutions Committee Report:
Gold, Silver and Monetary Policy

**9:10 A.M. Pre-Session Motion Picture**
"Nevada" (U. S. Bureau of Mines)

**9:30 A.M. OPEN PIT MINING**

Chairman: W. S. MOORE, *Pres.*, W. S. Moore Co., Duluth, Minn.

Open Pit Belt Conveyors
E. H. MULLIGAN, *Senior Engr.*, Steep Rock Mines, Ltd., Steep Rock Lake, Ontario

Current Trends in Heavy Conveyor Belts
ARTHUR ARGUEDAS, *Conveyor Belt Engr.*, Manhattan Rubber Div., Raybestos-Manhattan, Inc., Chicago

MARTIN VANDER LAAN, *Mgr. Operations*, Robins Engineers Div., Hewitt Robins, New York

Advances in Off-Highway Truck Design
GORDON CARLSON, *Mesabi District Mechanical Engr.*, Pickands Mather & Co., Hibbing, Minn.

Relative Economy of Six, Eight and Ten-Yard Shovels
EARL F. HANSON, Utah Construction Co., Salt Lake City

Slope Stability in Open Pit Mines
W. A. VINE, Mining Dept., Montana School of Mines, Butte, Mont.

**9:10 A.M. Pre-Session Motion Picture**
"Mining and Smelting the Sudbury Nickel Ores" (International Nickel Co.)

**9:30 A.M. UNDERGROUND MINING**

Chairman: FRANK COOLBAUGH, *Vice Pres.*, Western Operations, Climax Molybdenum Co., Golden, Colo.

Coal Mining Methods Applied to "Hardrock" Operations in Flat-lying Sediments
R. F. LOVE, *Asst. to Resident Mgr.*, Intermountain Chemical Co., Green River, Wyo.

Underground Ore Loading Equipment
CLAUDE O. DALE, *Asst. Gen. Mgr.*, Mining and Smelting Div., Eagle Picher Co., Miami, Okla.

Discussion: EUGENE P. REED, *Mgr.*, Raw Materials, Tennessee Coal & Iron Div., U. S. Steel Corp., Fairfield, Ala.

Operating Experience with Steel Cable Supported Conveyors
E. C. SKINNER, *Mgr.*, Potash Div., International Minerals & Chemical Corp., Carlsbad, N. Mex.

Plastic Ducts for Mine Ventilation
J. J. DALY, *Engr.*, Minerva Oil Co., Rosiclare, Ill.

**12:00 Noon LUNCHEON MEETING—BOARD OF GOVERNORS, WESTERN DIVISION, AMERICAN MINING CONGRESS—Junior Ballroom, Hotel Utah**

**1:40 P.M. Pre-Session Motion Picture—**
"The Story of Uranium" (U. S. Bureau of Mines)

**2:00 P.M. URANIUM**

Chairman: MARION F. BOLTON, *Mgr.*, Mining and Milling Operations, Kerr-McGee Oil Industries, Inc., Shiprock, N. Mex.

Future of Nuclear Reactor Power
J. CARLTON WARD, JR., *Pres.*, Vitro Corp., New York.

The Grants and Ambrosia Lake Areas
T. O. EVANS, *Chief Mining Engr.*, Atchison, Topeka & Santa Fe Railway Co., Prewitt, N. Mex

The Gas Hills, Wyoming District
J. A. MECIA, *Mgr.*, Mining Div., Utah Construction Co., San Francisco

Uranium Deposits in Eastern Washington
ROBERT B. FULTON, *Gen. Mgr.*, Dawn Mining Co., Ford, Wash.

**1:40 P.M. Pre-Session Motion Picture—**
"Production 5118"—the importance of employee communications

**2:00 P.M. INDUSTRIAL ENGINEERING—MANAGEMENT PROBLEMS**

Chairman: OSCAR A. GLAESER, *Vice Pres. & Gen. Mgr.*, Western Operations, U. S. Smelting Refining & Mining Co., Salt Lake City

Role of the Industrial Engineer in the Mining Industry
I. K. HEARN, *Chief Industrial Engr.*, Western Mining Divs., Kennecott Copper Corp., Salt Lake City

Communications—A Job for Top Management
ROBERT A. HARPER, *Asst. Director of Public Relations*, Koppers Co., Inc., Pittsburgh

Selection and Training of Prospective Executives
JOHN G. NEUKOM, *Managing Partner*, McKinsey & Co., San Francisco

What Can Research Do For Management Problems in Mining?
D. REID WEEDON, JR., *Vice Pres.*, Arthur D. Little, Inc., Cambridge, Mass.

**1:40 P.M. Pre-Session Motion Picture—**
"A Story of Lead" (U. S. Bureau of Mines)

**2:00 P.M. UNDERGROUND DRILLING SYMPOSIUM**

Chairman: ROBERT W. PERSONS, *Mgr.*, Drill Steel Div., Crucible Steel Co. of America, N. Y.

Drill Steel Developments in the Laboratory
FLOYD ANDERSON, *Chief Metallurgist*, Gardner-Denver Co., Denver

Use, Testing and Performance of Underground Drill Bits
JAMES W. CLEMENS, *Operating Engr.*, The M. A. Hanna Company, Iron River, Mich.

Discussion: M. W. HAWKESWORTH, *Gen. Sales Mgr.*, Western Rock Bit Mfg. Co., Salt Lake City
ROBERT H. HOLSING, *Asst. Chief Engr.*, Rock Bit Div., Timken Roller Bearing Co., Canton, Ohio

Underground Drill Machines
E. B. OLDS, *Asst. Supt.*, The Bunker Hill Co., Kellogg, Idaho

Discussion: ROBERT L. SANDVIG, *Research Engr.*, Thor Power Tool Co., Los Angeles
JACOB E. FEUCHT, *Chief Engr.*, LeRoi Div., Westinghouse Air Brake Co., Cleveland

**1:40 P.M. Pre-Session Motion Picture—**
"Decision in Chemistry"

**2:00 P.M. INDUSTRIAL MINERALS**

Chairman: G. DONALD EMIGH, *Director of Mining*, Monsanto Chemical Co., St. Louis

The Industrial Mineral
JOSEPH L. GILLSON, *Chief Geol.*, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

Place of Industrial Minerals in the Older Mining Company
MURL H. GIDEL, *Asst. Chief Geol.*, The Anaconda Co., Butte, Mont.

Industrial Minerals and the New Mining Company
CHARLES W. SWEETWOOD, *Asst. Mgr.* Exploration Div., J. R. Simplot Co. Boise, Idaho

The Chemical Company and Its Industrial Minerals
O. A. POWER, *Plant Mgr.*, Mineral Development Dept., The Food Machinery & Chemical Corp., Pocatello, Idaho

Role of the General Contractor in Industrial Minerals
J. V. OTTER, *Engr.-Special Services*, Morrison-Knudsen Co., Inc., Boise, Idaho

★ ★ ★

**7:15 P.M. ANNUAL BANQUET—**
Rainbow Randevu

# THURSDAY

## *September 12*

**9:30 A.M. to 4:30 P.M. TAX FORUM**—open to tax accountants and attorneys and interested mining men—Jade Room, Hotel Utah

Chairman: HENRY B. FERNALD, *Chairman*, Tax Committee, American Mining Congress

Discussion of current problems in connection with the Internal Revenue Code and Treasury Regulations thereunder.

**Geneva Steel Plant Field Trip**—Buses leave Salt Lake City at 8:15 A.M. return about 3:00 P.M.

**"Circle Tour"**—of mining and metallurgical plants. Buses leave Salt Lake City at 8:15 A.M. return about 4:00 P.M.

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*(Continued from page 52)*

Railroad project—where a huge quarrying and conveyor operation is employed in building a new causeway to replace the present wooden trestle across Great Salt Lake—can be reached by daily air service from Salt Lake City Airport.

Arrangements can also be made for those wishing to visit the uranium industry on the Colorado Plateau, en route to or from the Convention. Further information may be obtained from the Utex Exploration Co., P. O. Box 487, Moab, Utah.

**DON'T MISS IT**

If you haven't made plans to be in Salt Lake City the week of September 9, it is not too late to do so. No progressive mining man will want to miss his industry's big event of the year.

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# American Mining Congress

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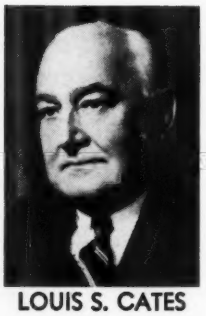

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Q

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R

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A Southern Ohio stripper cut over-all mining costs 25 cents per ton by augering low-cost recovery coal with this McCarthy Coal Recovery Drill. The recovery coal itself cost $1.25 less per ton than the strip coal.

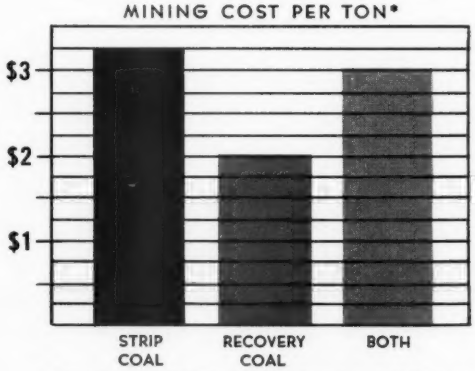
# AUGERED and STRIP COAL COMBINED CUTS STRIPPER'S COST 25 cents per ton

Auger-mine low-cost recovery coal to lower your stripping costs—as much as 25 cents a ton!

One Southern Ohio strip mine operator saved this much with only one McCarthy Model 14-30-36 Coal Recovery Drill. Working one six-hour shift per day with only two operators, he augered approximately 10,000 tons per month of recovery coal. The cost per ton, including make-ready, operation, maintenance, depreciation and hauling, was only $2. By spreading this saving over his entire operation, he cut his delivered strip coal cost from $3.25 to $3 per ton. Strip coal output was about 40,000 tons per month.

This is why more strippers each year add McCarthy Coal Recovery Drills to their list of production equipment. The McCarthy drill is a cost-saver and a money-maker. It's self-moving, all hydraulic, and requires only two operators. Contact the nearest Salem Tool representative for details. For immediate service, phone or write direct.

***It Pays to Auger-Mine Low-Cost Recovery Coal***




*Based on 10,000 tons of augered coal and 40,000 tons of stripped coal per month.

*Manufacturer of Drilling Equipment Since 1901*

**THE SALEM TOOL CO.**

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A coal company experiments with a process plotting work methods for later analysis and the application of work economy principles

# A METHOD STUDY PROCEDURE for Improving Face Costs

By G. W. LOCKIN
**Production Engineer**
**Inland Steel Co.**

INLAND Steel Company's present industrial engineering program was started in 1952, about two years after completing its mine mechanization program. Some limited time study work had been done prior to this time, mostly on special problems or equipment tests. The first 2½ years consisted primarily of time studying face cycles on all production sections. Covering most combinations of conditions and equipment. This period, in reality, was an introductory period for mine management and a training period for the time study engineer. We felt that by gradually introducing the program, rather than installing it as if it were a piece of equipment, we would realize greater value from it, particularly in the attitudes of our mine personnel. The acceptance of the program has been very gratifying. No strong measures were required for its acceptance as has been the case where some rapidly developed programs have been put into effect.

## Production Standards

Following this introductory period, a "section standard" or "section budget" program was developed. This was something management had desired for sometime but had been without a basis for establishing. The first standards were rather gross but served as a basis for later improvements. The foundation of this first standards program were the "standard times" obtained by time studies. An additional man was added to the department at this time so that both the standards program and time study program could be maintained sufficiently to permit later improvements in the over-all plan.

## Foreman Training in Industrial Engineering

Another important measure that aided in the collection of standards data was the establishment of a "foremen training program" in industrial engineering. This training program is another subject in itself, which we will not go into, other than to say its primary function is to give the production foremen a basic working knowledge of time study. In learning to make, work up, and analyze time studies and method studies, the foremen not only see time study from a different point of view but also get a new slant on their own jobs. The relationship of time study to their job is the main objective of the training. With this additional means of collecting standards information, it was not long until we were able to revise and strengthen our production standards procedures.

## Standards Revision

Our first major revision has just recently been completed with the desired refinements incorporated. Actually, revising or establishing standards for new operations is never completed. About the time you think you have every thing under control with "good standards," one section starts using three shuttle cars instead of two, or maintenance adds high speed gears to the loaders, or management buys some new souped-up shuttle cars. Collecting data for standards never stops, unless progress stops, and half of any industrial engineering job is to see that progress does not stop.

## Method Study Procedure

At present we are experimenting with a procedure for studying work methods of the face cycles. What we are trying to do is not a new or different procedure than other industries have been using for many years. The author's first contact with an application of this type was at Inland Steel's harbor works, where industrial engineers demonstrated its use in long cycle jobs similar to our mining cycles. They suggested we try it on our face operations and pointed out that many improvements in work methods might be found even though natural conditions will vary the work cycles.

Industrial engineering text books tell us that we must first study methods, perfect the best method, then time study that method and set standards. It is here that the coal mining industrial engineers have had to revise or reverse the text book theories. With the extremely variable conditions encountered in mining, it is impractical to develop the "best method" for all of these conditions. That which would be the best method today, would not be tomorrow or next week. For this reason techniques of method studies have not been extensively used in the coal industry; at least those which have been developed have not been widely publicized. The use of method

studies as a prerequisite to time standards may be of little value in mining, but its application as a means of applying the principles of work economy are still worthwhile.

It is from this standpoint that we are experimenting with a method study procedure. This procedure is simply a process of graphically or symbolically plotting work methods for later analysis and the application of work economy principles. The process can best be explained by discussing the work sheets used in making the studies.

For brevity, the example chosen will be only the unloading operation of a shortwall cutting machine on an off-track section.

**Figure 1** shows the work sheet partially filled in. There are four columns for the collection of information for each workman—the symbol column, the time column, the distance column, and the description column. The machine operation is shown only by a symbol column. The main problem in making the study is to get all the necessary information down in enough detail so that later the job can be followed step by step, as though looking at a film strip, frame by frame. In industries where motion pictures can be used, this symbolic charting is actually made from a film strip and times are obtained by counting the number of frames required for each step. Without the film record, the job is a good deal more difficult, but not impossible.

Key to method study taking and analysis is in the use of the symbol column. The four symbols in this column each represent a type of action that can be briefly described:

1. **The circle** indicates machine operation. It is checked when either workman operates the machine for any reason.
2. **The arrow** is checked for any movement of either of the men requiring more than one step.
3. **The square** is for man operation and is marked for manual operations such as shovel, set jack, test top, and the like.
4. **The triangle** is wait or delay.

**Figure 1** also shows how these symbols are used. The observer has only been able to plot part of the information needed. His first task is to mark the symbols and note the procedures of each man in relation to the other. You can see how this is accomplished, by using the symbol column with brief notes describing the action. Here, abbreviations or letter symbols are extremely useful. Note that time has not yet been recorded. It would be almost impossible to plot methods and record element times on both men at the same time. In method studies, time is of secondary importance. The main object is to plot the sequence of work of both men as accurately as possible and with as much detail as possible. This plotting process is done in the first two or three places or until the normal sequence of operation is determined. The time elements are then filled in to the best of the observer's ability in the remaining places that are worked that shift. From this we are able to arrive at a quite accurate record of the crew's work sequence and a fair indication of time requirements. In obtaining time, either the snap back or continuous time method can be used. So far we have tried only the snap back timing method, but feel the continuous method may have some advantage in recording where the snap back has some advantage in work up.

INLAND STEEL COMPANY
METHOD STUDY CHART

Place # 2 A.C. Height 41" Width 16' Depth 7½'

○ Machine Operation □ Man Operation ⇨ Move ▷ Delay

| | Time | Dist. | OPR. | | Time | Dist. | HLPR. |
|---|---|---|---|---|---|---|---|
| ○⇨□▷ | 8 | 80' | TRAM | ○⇨□▷ | 8 | 80' | TRAM |
| ○⇨□▷ | 1 | | WT. | ○⇨□▷ | 1 | 10' | TO MCH. |
| ○⇨□▷ | 4 | | ↓ | ○⇨◪▷ | 4 | | UNLD. TOOLS |
| ○⇨□▷ | 1 | | ↓ | ○⇨□▷ | 1 | 6' | TO ROPE |
| ◪⇨□▷ | 5 | | RUN OFF ROPE | ○⇨◪▷ | 5 | | PULL OFF ROPE |
| ○⇨□▷ | 3 | | WT. | ○⇨□▷ | 3 | 20' | GET PICK-T-2 |
| ○⇨□▷ | 4 | | ↓ | ○⇨◪▷ | 4 | | STAMP HOLE |
| ○⇨□▷ | 2 | | ↓ | ○⇨◪▷ | 2 | | SET JK. |
| ◪⇨□▷ | 2 | | TIGHTEN ROPE | ○⇨◪▷ | 2 | | HOLD JK. |
| ○⇨□▷ | 1 | | WT. | ○⇨□▷ | 1 | 7' | TO SFTY. JK. |
| ○⇨□▷ | 1 | | ↓ | ○⇨◪▷ | 1 | | MOVE JK. |
| ◪⇨□▷ | 4 | | UNLD. MCH. | ○⇨□◺ | 4 | | WT. |
| ○⇨□▷ | | | | ○⇨□▷ | | | |
| ○⇨□▷ | | | | ○⇨□▷ | | | |

Figure 1. The work sheet partially filled in

INLAND STEEL COMPANY
METHOD STUDY CHART

Place # 2 A.C. Height 41" Width 16' Depth 7½'

○ Machine Operation □ Man Operation ⇨ Move ▷ Delay

| | Time | Dist. | OPR. | | Time | Dist. | HLPR. | MACH. |
|---|---|---|---|---|---|---|---|---|
| ○⇨□▷ | | 80' | TRAM | ○⇨□▷ | | | TRAM | |
| ○⇨□▷ | | | WT. | ○⇨□▷ | | | TO MCH. | |
| ○⇨□▷ | | | ↓ | ○⇨◪▷ | | | UNLD. TOOLS | |
| ○⇨□▷ | | | ↓ | ○⇨□▷ | | | TO ROPE | |
| ◪⇨□▷ | | | RUN OFF ROPE | ○⇨◪▷ | | | PULL OFF ROPE | |
| ○⇨□▷ | | | WT. | ○⇨□▷ | | | GET PICK | |
| ○⇨□▷ | | | ↓ | ○⇨◪▷ | | | STAMP HOLE | |
| ○⇨□▷ | | | ↓ | ○⇨◪▷ | | | SET JACK | |
| ◪⇨□▷ | | | TIGHTEN ROPE | ○⇨◪▷ | | | HOLD JACK | |
| ○⇨□▷ | | | WT. | ○⇨□▷ | | | TO SFTY. JK. | |
| ○⇨□▷ | | | ↓ | ○⇨◪▷ | | | MOVE JK. | |
| ◪⇨□▷ | | | UNLD. MACH. | ○⇨□◺ | | | WT. | |
| ○⇨□▷ | | | | ○⇨□▷ | | | | |
| ○⇨□▷ | | | | ○⇨□▷ | | | | |

Figure 2. A portion of the study after time has been included

**Figure 2** shows a portion of the study as it would look after time has been included. Any distances not obtained during the plotting procedure are added during the timing.

By now you are probably wondering just how all these symbols, times, and notes can be used to develop more effective work methods. To begin, the normal sequence of operation is plotted from the four or five places observed and timed. There are usually some variations in work procedures from place to place; therefore, the most normal procedure is used.

**Figure 3** shows the final work up on the example we have been using. This is called the "present method," since it is the method which the crew

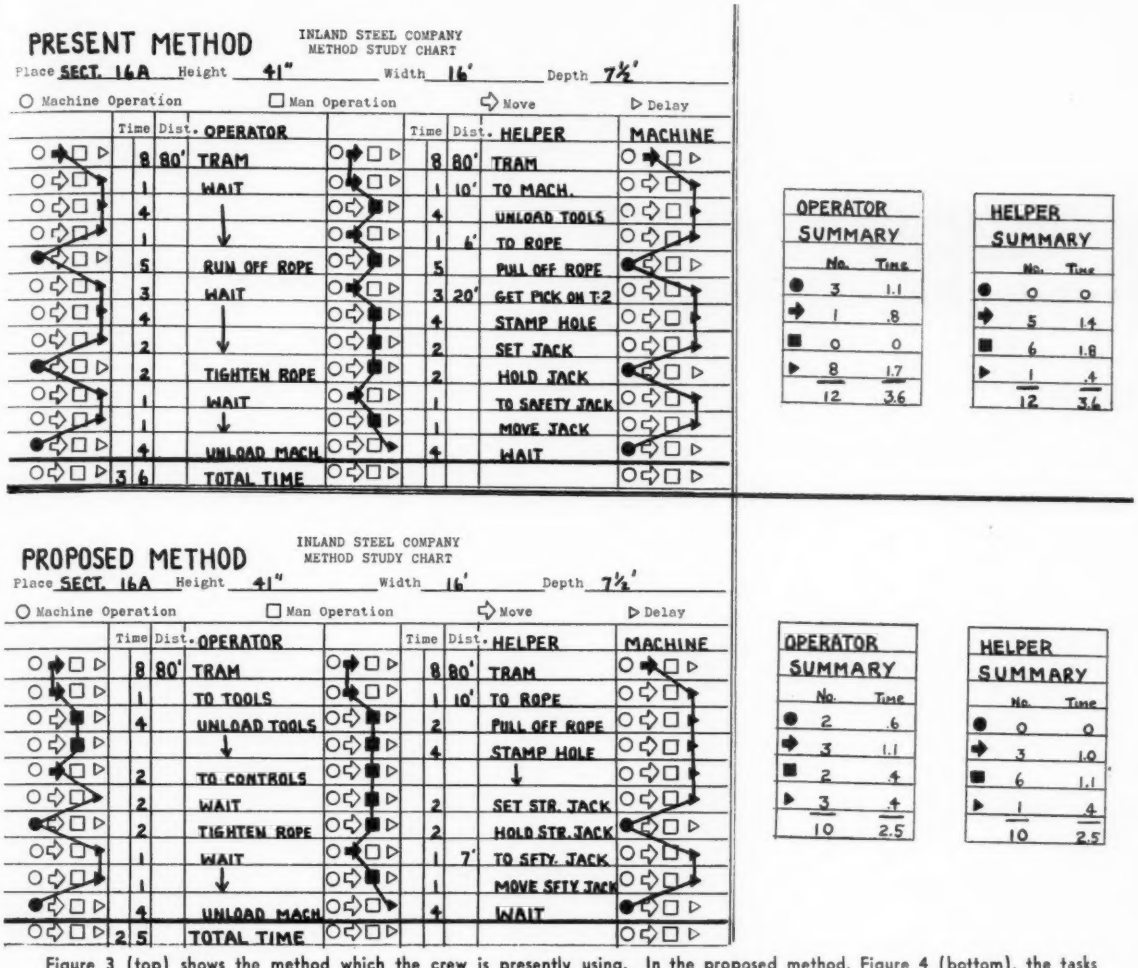



Figure 3 (top) shows the method which the crew is presently using. In the proposed method, Figure 4 (bottom), the tasks have been equalized between both workmen

is presently using. It is now illustrated by a series of "still pictures" that permits study and analysis in a way not possible by observation or time study. Without going into a text book dissertation on applying the fundamentals of work economy, the following is an explanation of how we analyze a study for possible savings in time and effort.

By using a check list of questions designed to require the analyst to consider all possible principles of work economy, the present method is studied for possible improvements. This check list is actually three lists covering the different classes of work changes possible. The lists are too lengthy to go into at this time, but the type of questions which they are designed to stimulate are something like this:

**1. Are the fewest possible movements used to accomplish the task?**

**2. Are tools in most accessible place?**

**3. Are tools in proper condition?**

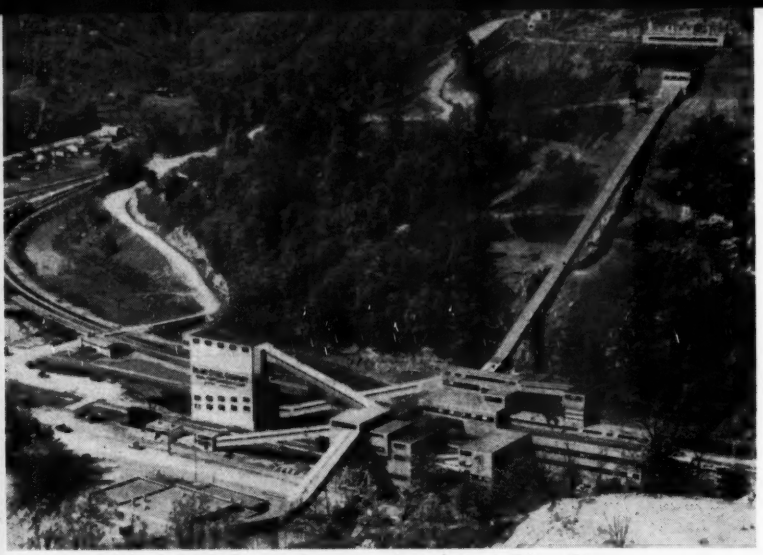
**4. Are controls in best location?**

**5. Is the right man doing the job, etc.?**

To see how this process works, let us look at the "present method" and see what changes might be made. FIRST, it is evident that the operator is waiting for the helper to do all the service duties, i.e., unloading tools, pull off rope and move safety jack. In the "proposed method" (see Figure 4) we have tried to equalize these tasks between both workmen, and have the times coincide. SECOND, the rope had to be run off, indicating the machine was not in top condition. THIRD, the helper was making an unnecessary trip back to the machine to get his pick.

You may think these three things should have been noticed by the foremen or by a time study observer rather than requiring a special study such as this. Possibly you are right, but often these things are overlooked. The foremen has a great deal to think about as it is, and the time study man is intent on timing the operation. The foreman may know the machine is not in top shape but cannot see how much it is affecting the cutting. The changes in this example are quite obvious. This was done for ease in illustrating the subject; however, frequently possible improvements in work sequence are not evident at all until they are plotted step by step in this manner.

Another way in which method studies have an advantage over time studies is in their ability to help sell the need for improvement. Their major value can be in this one advantage alone. We all know the difficulty in changing peoples' way of doing things. Before they will willingly change their work habits, they have to be sold on the advantages of any change. We are not suggesting that these forms



Inland Steel Company's preparation plant at Price, Ky.

be taken directly to the workmen. The section foremen have to do the selling and this procedure gives him the necessary information on which to sell. The changes, suggested in this example of just unloading a machine, figures about one minute saved. If two additional minutes could be gained in the same manner on the remainder of the cycle, the crew would be able to pick up an additional cut per shift. This would be well worth the effort spent in making the study and well worth the foreman's time in making the changes. Another aid to selling is illustrated by **Figure 5** which is a sketch of the present and proposed methods. Note how the movements of the two men have been equalized and wait time of one man eliminated.

This has been a rather brief discussion of the subject and we can give no glowing report on how beneficial this has been to us. As noted before this is still in the experimental stage, but from all indications it appears to be adaptable to mining and very useful in applying the principles of work economy.

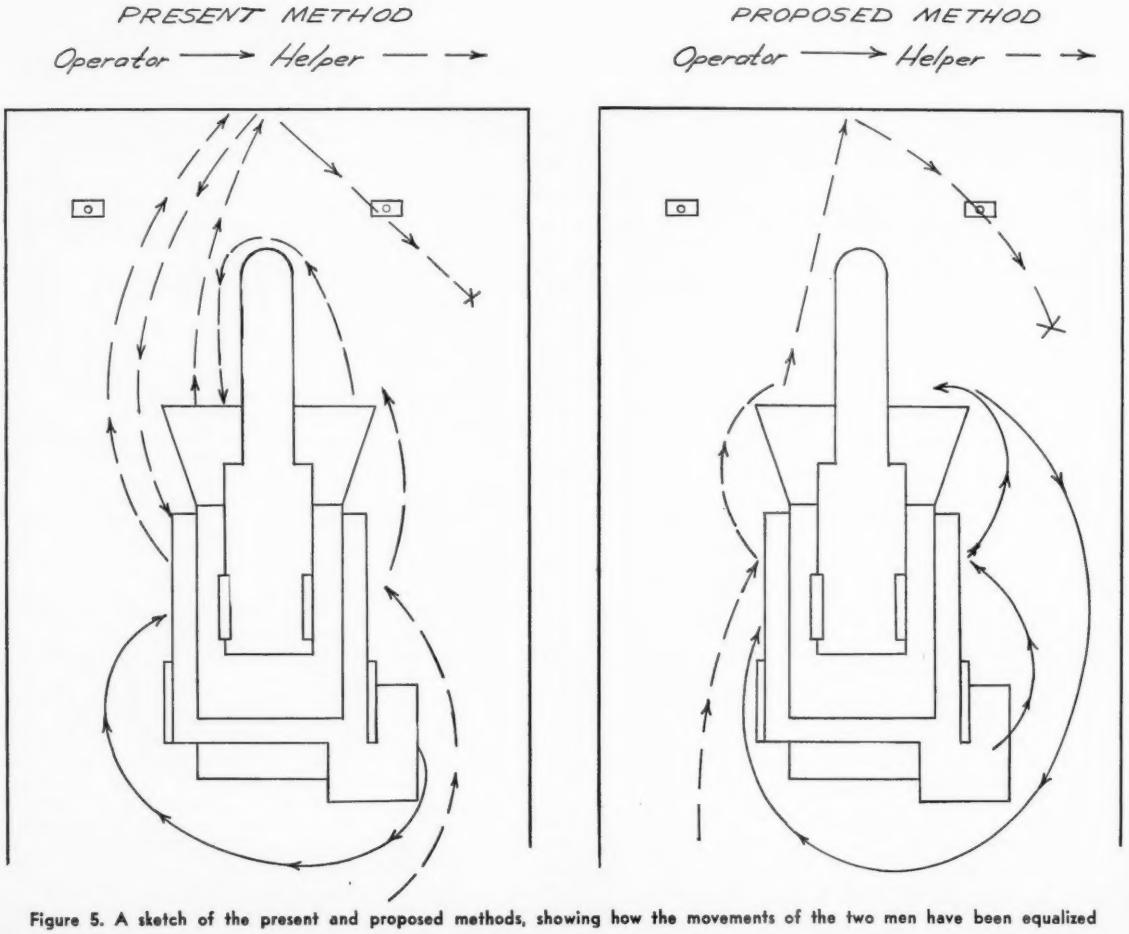



Figure 5. A sketch of the present and proposed methods, showing how the movements of the two men have been equalized

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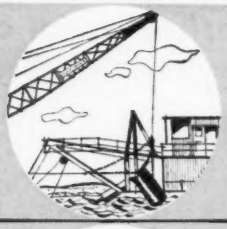

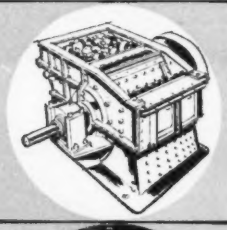

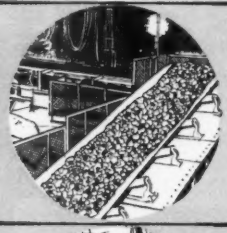

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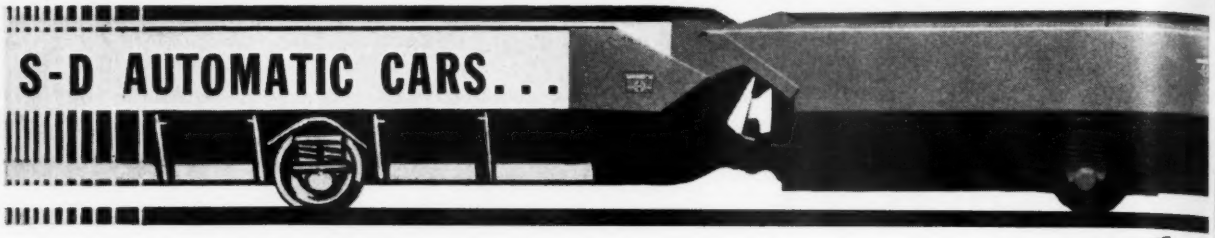


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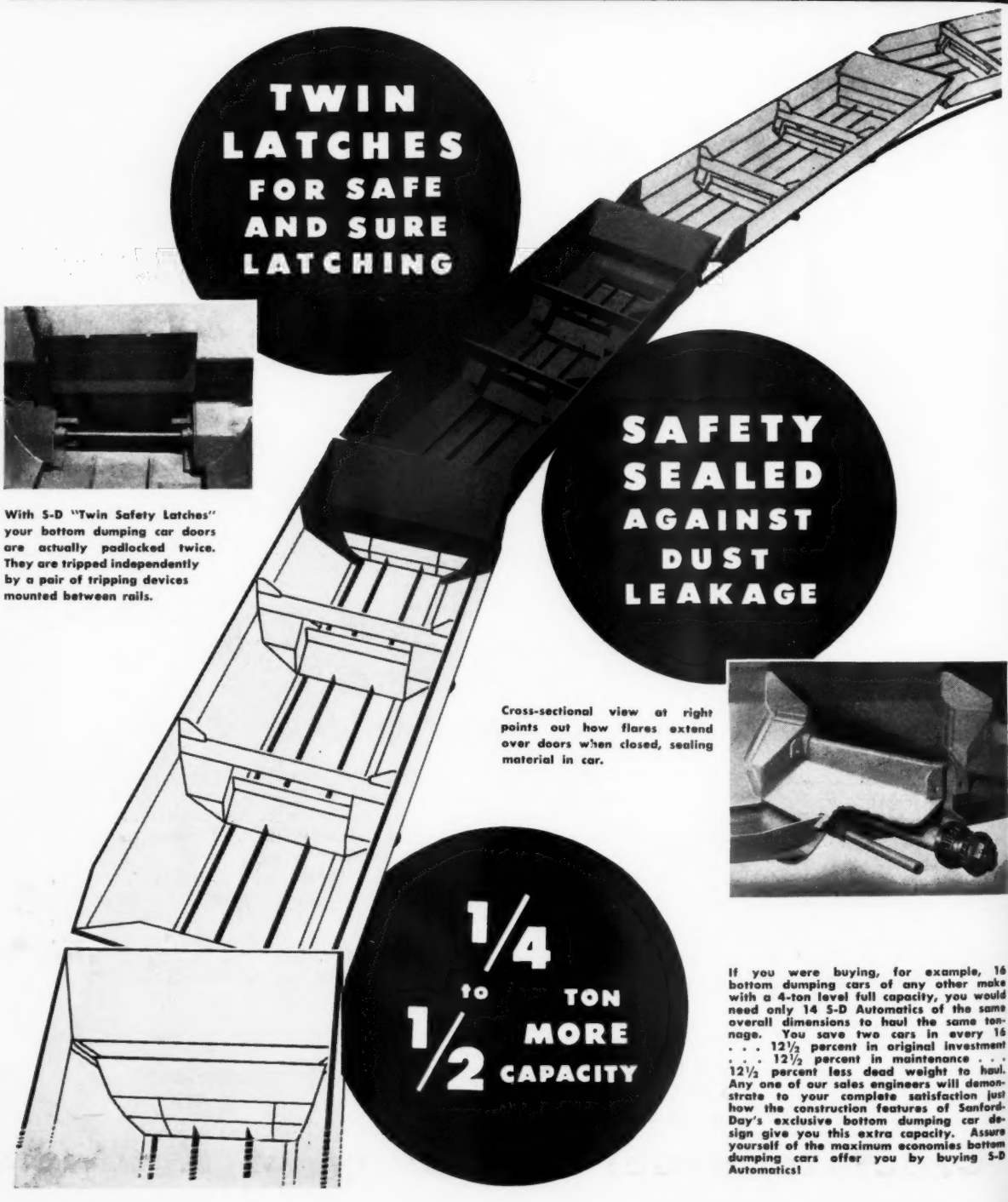

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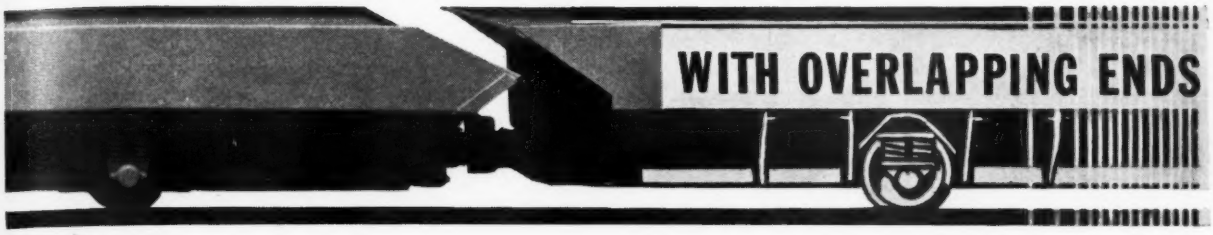
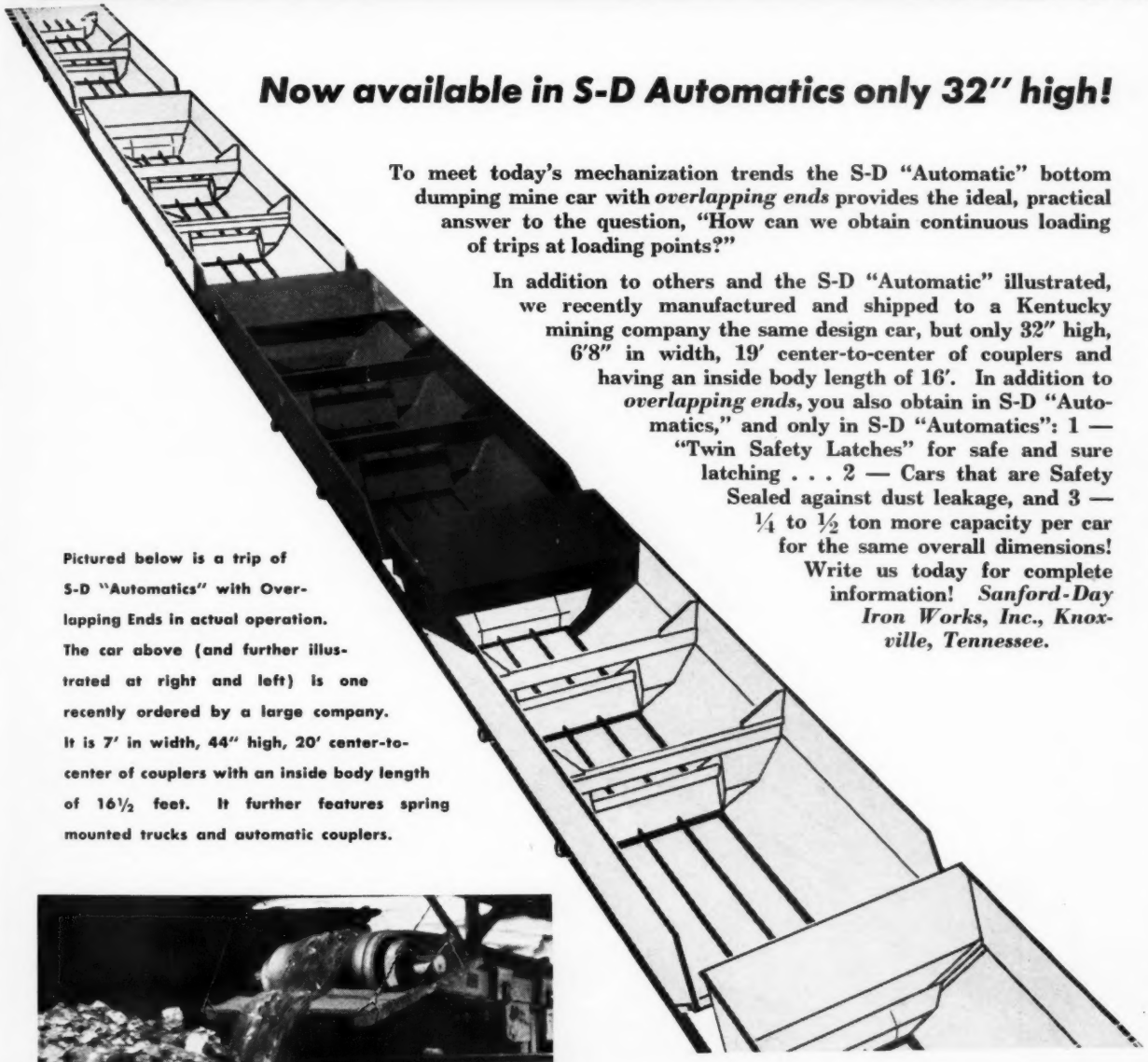


# WITH OVERLAPPING ENDS



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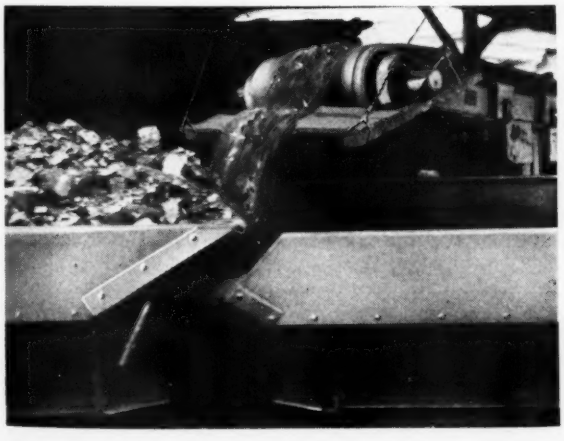
**Pictured below is a trip of S-D "Automatics" with Overlapping Ends in actual operation. The car above (and further illustrated at right and left) is one recently ordered by a large company. It is 7' in width, 44" high, 20' center-to-center of couplers with an inside body length of 16½ feet. It further features spring mounted trucks and automatic couplers.**



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# Emulsion Flotation

By A. W. FAHRENWALD

Emulsion flotation at Manganese, Inc., is remarkably successful. The chemistry and/or interfacial forces involved are on the speculative side, but recovery has steadily increased and is now in the 80 to 90 percent range

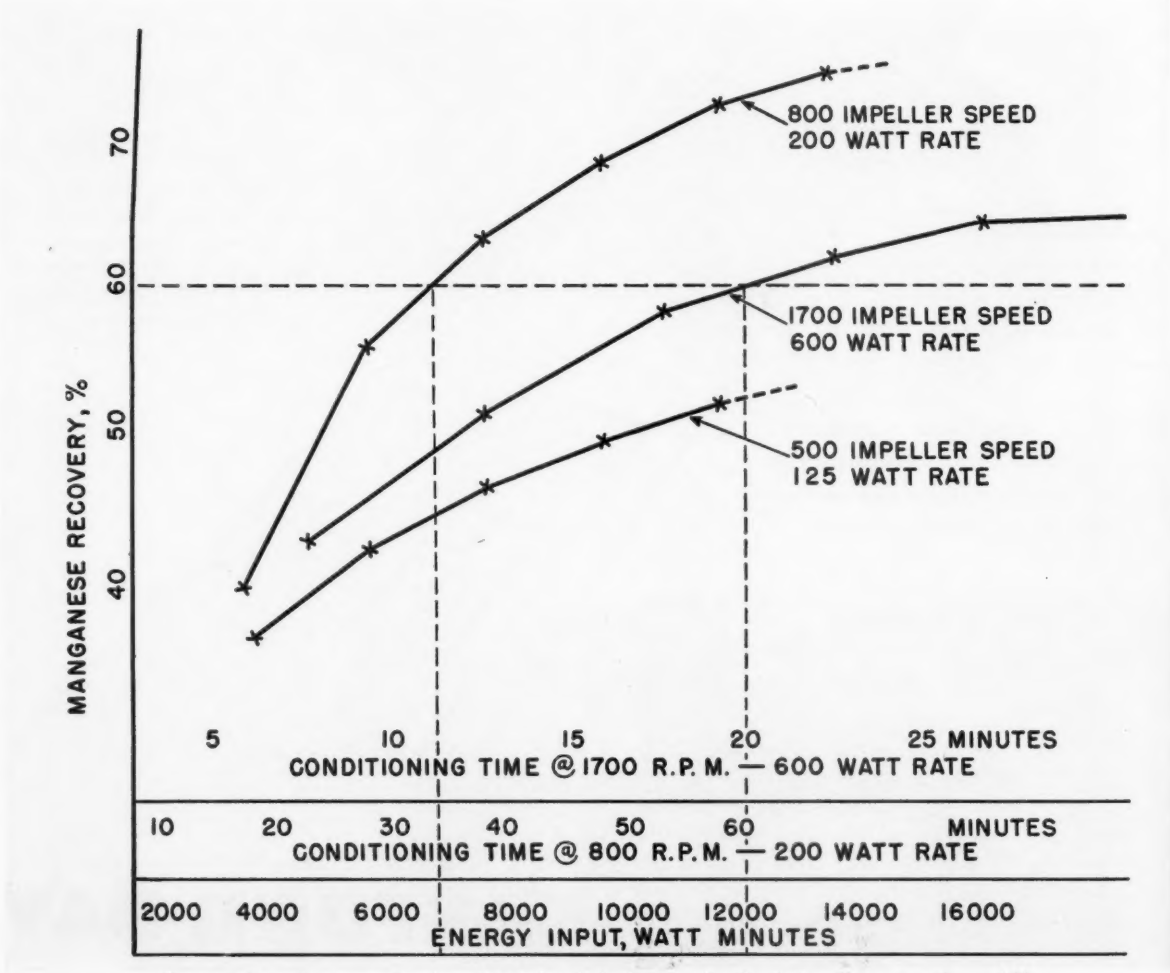



Figure 1. Data from several series of tests in which the intensity-of-agitation factor was the variable

THE point of view from which this article is written is that gained in experience with emulsion flotation as applied and practiced at Manganese, Inc., Henderson, Nev.

To those of us who have not had experience with what the author here calls emulsion flotation, there is probably only one kind of flotation—namely, froth flotation. In froth flotation bubbles, individually, collect mineral particles, rise to, and collect at the surface of the aerated pulp in the form of froth. A unique characteristic of froth flotation is the small amount of reagents (a few pounds at most) required per ton of ore treated. Conditioning of the pulp with the reagents, in terms of power expenditure, is not a major operation. There is a reasonably well accepted theory of froth flotation. The reactions involved are in most instances satisfactorily explained by basic chemical theories.

Emulsion flotation, while it involves all the essential elements of froth flotation, is a process employing reagents, soap and oil in emulsion form, in amount many times that required for froth flotation—as much as 200 lb per ton of ore. The amount depending upon the flotable mineral content of the ore, the water-solubility of the gangue minerals and to a degree upon the total surface of the to-be-floated mineral. It is seemingly a process more applicable to non-crystaline minerals than to crystaline minerals, and can better cope with slimes than can froth flotation, to which process slime is poison. Over grinding, while it leads to higher reagent consumption and all round economic loss, seems not to be as serious in emulsion flotation as in froth flotation. There is some evidence, however, of a relationship between specific surface and the total energy required for conditioning.

The essential reagents employed in emulsion flotation are: 1) a primary activating agent and 2) the emulsion, consisting of a neutral oil, soap and a wetting agent. Control of p H is seemingly not too critical an element in the success of the process, the implication of which is that in emulsion flotation one is dealing with multimolecular interfacial layers rather than mono-molecular.

The theory of emulsion flotation, as applied to manganese ores, is not well established and the discussion which follows is speculative.

### Conditioning and/or Sequestering Agents

This type reagent may be used advantageously when there are soluble minerals in the ore which when in solution provide ions available to react with soap to form insoluble soaps, thereby consuming soap. These soap consuming elements may be partly blocked out by: (1) employing a sequestering agent to form inert complex ionic groups, or (2) precipitation, as by use of soda ash or by the use of soap to form insoluble soap. This step is not employed currently in the process.

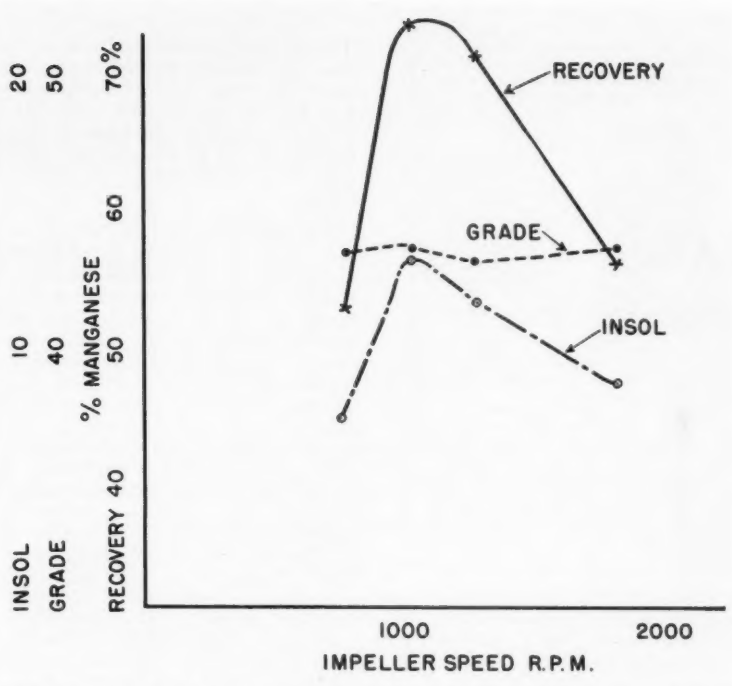



Figure 2. A series of conditioner tests in which impeller speed was the variable. Time of conditioning was constant at ten minutes

### Activating Agents

The function of this reagent, and the theory of its action, is presumably not unlike that of the use of activators in froth flotation—namely, to provide sites on the surface of the mineral to

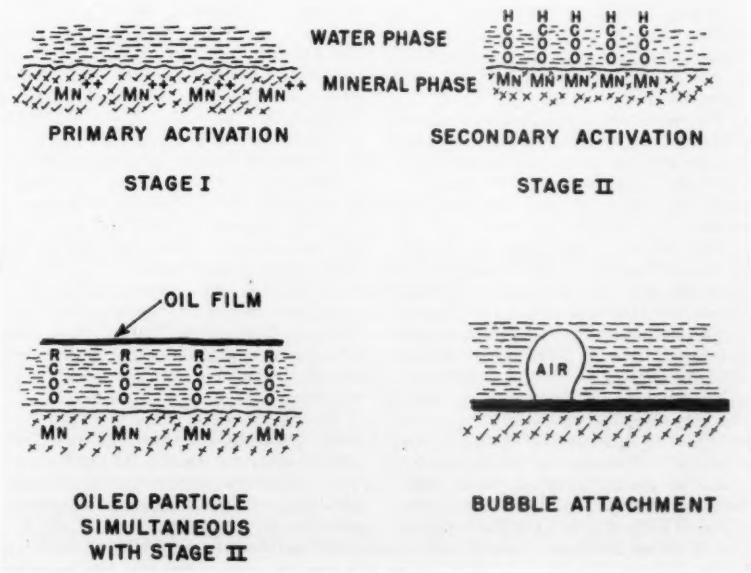



Figure 3. Sequence of surface actions—there seemingly is involved a two-stage activation of the mineral

**A. W. Fahrenwald received the degrees of B. S. and Met. E. from the South Dakota School of Mines in 1914 and 1916 respectively, and an E. M. from the New Mexico School of Mines in 1916.**

**His experience includes: prof. of Mining and Metallurgy, New Mexico School of Mines, 1916-18; prof. and head, Departments of Mining and Metallurgy, School of Mines, University of Idaho, 1928-1954; dean, School of Mines, University of Idaho, 1928-30 and 1934-54 and director, Idaho Bureau of Mines and Geology, same years.**

**Author of numerous technical and scientific papers in the various fields of mineral dressing, he has done consulting work at various times for some two dozen mining, chemical and manufacturing corporations. He is also the inventor and/or developer of mineral dressing processes and machines.**

be floated, to serve as anchoring or reaction points for the collector reagent (the reagent here alluded to is soap and the part it plays in emulsion flotation is presumed to be that of secondary activator—and is, therefore, actually not the collector). The activating reagent currently in use is liquid sulfur dioxide, although Mn $SO_4$ and/or Fe $SO_4$ are shown in lab tests to serve nearly equally well to effect the required state of activation.

## The Emulsion

The emulsion components are: a petroleum oil; a soap, and a wetting agent (the surface active reagent found most effective is a sulfonate of the trade name Oronite S), compounded in various proportions. The function of the wetting agent is conjectural and its importance in respect to the amounts used, is variable with different ores.

The emulsion presumably is one of oil-in-water. Soap, possibly assisted by the wetting agent, is the emulsifying agent. It would seem that the soap and the oil have independent actions and each is the carrier of the other. It is at this point in the discussion of the mechanism of emulsion flotation that the function of soap is unlike the function of soap in what is known in mineral beneficiation as soap flotation. The reaction of the soap (R COO—) at the mineral surface—the primary activator having paved the way for this reaction—is presumably not unlike that of soap in soap flotation. The mineral surface is covered, or partly covered, with water insoluble manganese soap—the water-mineral interface temporarily consisting of water insoluble, but oil soluble, hydrocarbon groups. At this stage the neutral oil, in which the R groups are soluble, takes over covering the particles with a water-repelling oil surface.

Here we have, seemingly, to all intent and purpose the novel situation of a two-stage type of activation—first by a metal salt, and secondly by soap—the neutral oil functioning as the collector. The sequence of surface actions is imaginatively depicted in Figure 3.

## Conditioning—A Power Process

In emulsion flotation, in particular as applied to the manganese ore of Manganese, Inc., is a major operation in terms of the metallurgical and economic success of the process. The power expenditure for conditioning far exceeds that for grinding the ore—or that expended in the subsequent flotation step. Not only does the conditioning operation require heavy power expenditure, but the success of the conditioning operation, appraised in terms of metallurgical results, is related to the manner of the power application. A unit of work, in the form of stirring, or agitating of the pulp, may be expended 1) at a high rate over a short time period, 2) at a low rate over a longer time interval or 3) differentially at a high rate followed by a low rate, or vice versa. These various procedures do not all produce the same metallurgical result, although the total energy input, by each procedure, be the same.

Data from several series of tests, in which the intensity-of-agitation (rate of energy input) factor was the variable, are presented in Figure 1. The respective curves result from plotting recovery vs time of agitation for each impeller speed (rate of work input).

It may be noted that the rate of conditioning is highest for the 800 impeller speed (200 watt rate), lowest for the 500 impeller speed, and at an intermediate rate for the 1700 speed. Not only is the rate of conditioning highest for the 800 speed, but the ultimate recovery, irrespective of time of conditioning, (total energy of conditioning) is best for the 800 speed. If one selects arbitrarily a recovery of, say, 60 percent and draws a line at this recovery level parallel to the horizontal axis of the graph, it is seen that at the 800 speed, roughly 6500 watt-minutes of energy are required; for the 1700 speed, 12,000 watt minutes are required and for the 500 speed, the 60 percent recovery is unattainable.

In this series of tests the pulp dilution and pulp volume (weight of dry solids) was constant. One can therefore state the power required in conditioning in terms of units of energy per ton of dry solids.

A series of conditioner tests in which impeller speed was the variable, is presented in Figure 2. Time of conditioning was constant at ten minutes. It may be seen, that in this case, the highest recovery occurred at impeller speed about 1100 rpm and fell off sharply at speeds above this optimum.

That conditioning is so critical in emulsion flotation, with respect to the two factors, time and intensity of agitation, has been proved over and over. To still further emphasize the tempermental attitude of emulsion flotation to conditioning in its various aspects, it has been demonstrated that the highest efficiency in terms of metallurgy results from what may be termed differential conditioning, i.e. moderate-intensity conditioning followed by finishing conditioning at a relatively higher intensity. The reverse order is less effective. It is obvious that one is dealing with physical and chemical mechanisms of fundamental nature.

## Conditioning—Grinding in Reverse?

It has become more and more evident that emulsion flotation, unlike froth flotation, is a process seemingly capable of dealing with slimes as well as with normal sandy feeds—however, at a cost in reagents and in mechanical working of the pulp with the emulsion.

The obvious, physical effect of conditioning is to gather the dispersed mineral, eventually to be floated, into flocs. This appears to be, among other effects, the function of conditioning, i.e., conditioning may be looked upon as a process of grinding in reverse, i.e., a process of floc forming, essentially non-ionic in nature, involving surface and interfacial tensions. A process, to all intent and purpose, unlike grinding, of putting surface back together. Excessively intense agitation, Figure 2, may be looked upon as being destructive of the floc forming mechanism.

Emulsion flotation at Manganese, Inc., is remarkably successful. As more and more power per ton of ore treated is provided in the conditioning operation, recovery has steadily increased and is now in the 80 to 90 percent range. The management, ever alert to the value of research, is to be commended and congratulated.

# United Mine Workers Role in Accident Prevention

By CHARLES FERGUSON
Safety Director
United Mine Workers of America

**The safety director of the United Mine Workers of America outlines the work that the union is doing to reduce mine accidents, stressing the importance of cooperation between the union, mine management and state and Federal inspectors**

THE Safety Division of the International Union has only one function and one goal—increased safety in the coal mining industry and the reduction of accidents. Achieving this goal is a hard, unending struggle, but the progress made over the years has demonstrated that this objective can be achieved.

The attitude of the United Mine Workers has been demonstrated by its constant and intensive struggle for reasonable safety in the coal mining industry. We have fought diligently for Federal and state legislation, written provisions for safety have been incorporated in our contracts with management and we have expended major efforts in educating our membership safetywise throughout the country. These endeavors, coupled with the cooperation of the safety-conscious segments of the industry, have resulted in some improvement.

The United Mine Workers cannot and will not adopt a pacific attitude toward coal-mine safety. Until such time as the injury rate does not include those which could be prevented by reasonable precautions, we will continue to operate with determination through every channel at our disposal in an attempt to revise the story of the unnecessary deaths and injuries to our membership.

## Complete Cooperation Necessary

We are fully cognizant of the fact that safety can only be achieved through the complete cooperation of all parties concerned. This includes top management, state and Federal organizations and the Union from the International Organization to every member of the local union. To achieve this cooperation, the Safety Division of the International Union has done everything within its power to bring about closer understanding between all of the above-named agencies. To do this, we have engaged in a multiplicity of activities, none of which by itself is an answer to the entire problem, but taken as a whole, have made major contributions to the safety movement. Some of these activities are as follows:

(1) We have joined with and participated actively in the formation and perpetration of Holmes Safety Councils and Chapters throughout the nation.

(2) We have carried on an intensive educational campaign to the extent that over 158,000 of our membership have completed the accident prevention course given by the U. S. Bureau of Mines, with over 200 local unions participating 100 per cent.

(3) The entire membership of one of our districts, comprised of approximately 14,000 men, have completed this accident prevention training.

(4) We have affiliated with the National Safety Council and have been extremely active in furthering the programs of the Council.

(5) Even now we have joined with the Council and the industry in a campaign to reduce roof-fall accidents (which is our number one killer).

(6) The Safety Division actively participates in many other campaigns such as The President's Committee on Highway Safety and The President's Committee to Employ the Physical Handicapped.

## District Programs

In addition to the above, our various district organizations which are authorized to function within their jurisdictional areas have initiated and carried out programs designed to meet their particular needs. One of these programs is now in effect in District No. 29. Some of the activities carried out are listed below because they are reaching the man at the face which in the final analysis is the only answer to more safety in the industry.

1. State and Bureau personnel will contact all available management and employees, mining institutes and related organizations on the roof-fall problem and ask for full cooperation and help, particularly with reference to ideas which might be beneficial.

2. Attempt to arrange that each man in the industry, particularly the section foremen and the face employees, understand fully his duties and responsibilities in connection with preventing roof falls.

3. Instruct so that each man will know that he must comply with all timbering rules and regulations at all times and that this compliance can and should be part of everyday work-

ing habits. Further, each man must know that such compliance is an absolute necessity.

4. When either the state or Federal inspector finds substandard timbering during an inspection, he should get the name of the man or men involved, the exact location and the name of the section foreman. This information should be forwarded to the inspector's main office and records kept at the main office of the department of mines and the Bureau of Mines. A copy of the information should be forwarded to the district office of the United Mine Workers of America and to the highest local company official. The district president, if feasible, should write a letter to the man informing him that the district president has been advised that he had been working under roof that was loose or inadequately supported and that continued exposure in such areas would result in injury or death.

5. As much as possible, arrange to have state and Federal inspections at least a month apart in the various mines.

6. Suggest and arrange that underground sectional safety meetings be held weekly or at least bi-weekly.

7. Insist that state and Federal inspectors observe more closely the system of mining, with particular reference to adequate roof support—referring particularly to location of crosscuts, width of working places, et cetera.

8. Prepare slides showing fatal roof-fall injury areas and see that this information is disseminated in the areas neighboring the mine where the fatal injury occurred. Prepare oversize sketches of the fatal injury for discussing at Holmes meetings, safety meetings, and related meetings.

9. Make every effort to see that men and foreman know the mining law, Code, and company rules regarding roof-control practices; absolute compliance with such rules must be forthcoming if improvement in the roof-fall record is to be made.

10. Arrange to have each state and Federal inspector talk to each face employee on every visit in the mine regarding the roof-fall record, timbering rules in effect at his mine, the danger of working under inadequately supported roof and the need for working under safe conditions.

11. Request time at safety meetings, institute meetings, and other related programs to discuss roof-fall, preventive measures. Each of us should discuss roof-fall, preventive measures every opportunity available.

12. Arrange that inspectors will make a greater drive to have conventional roof supports replaced with roof bolts in face areas at as many additional mines as possible.

13. The Bureau will arrange to have two or more men in District C devote all of their efforts to preventing roof-fall fatalities in mines where conventional roof supports are used.

In our District 11, which is located in the State of Indiana, a program of this type has proven to be highly successful. This program stems from a permanent committee which meets monthly to discuss means and ways of furthering the program. The committee is composed of top management, top district officials, the insurance carriers and representatives of the State and Federal Bureau of Mines. Other operators should inquire about this program because it represents the ultimate degree of cooperation in safety matters.

## Handling of Safety Grievances

Some time ago, a procedural program was adopted for the handling of safety grievance. This program or procedure was adopted because of the misunderstandings that were prevalent in the handling of safety problems and to provide means by which these problems could be solved in a practical, cooperative manner. The program is outlined as follows:

1. Each district representative shall be educated in the contents of the Federal Mine Safety Code and be made fully responsible for compliance with its various provisions by the individual mines within his assigned jurisdiction. He will consider Code compliance equal in magnitude with his other assignments and will diligently strive to influence the responsible officials at the mine property to eliminate all Code violations, particularly those which have existed during consecutive Federal inspections, and have been designated as repeat violations.

2. The persons within the district organization designed to receive correspondence from the Safety Division relative to the division's evaluation of a Federal inspection will immediately upon receipt of such communication place it in the hands of the district representative responsible for the area in which the mine is located, instructing him to contact the operating officials at the mine to determine the extent of cooperation extended by such officials in the elimination of any and all cited violations of the Code. He shall upon the completion of his investigation send duplicate copies of his report in writing to the district office on what disposition has been made of the dangerous conditions listed in the Federal report. The district office shall in turn forward one copy of this report to the Safety Division in Washington, D. C.

3. Upon receipt of information by the district office of a serious injury or fatal accident occurring at a mine within the jurisdiction of the district, the field worker responsible for such area shall be instructed to proceed immediately to the scene of the accident, join with whatever groups are investigating the accident and, upon the conclusion of the investigation, submit two copies of his findings to the district office. The district in turn will forward one copy of such report to the Safety Division. Upon receipt by the district office of the final Federal report on such accident, the report shall be placed in the hands of the field worker, who shall arrange a meeting with the mine officials and the safety committee at the mine for the purpose of discussing the accident and the action to be taken to eliminate any recurrence of such accident. The field worker shall submit a duplicate copy of his report of this meeting to the district office who will forward one copy to the Safety Division.

4. Whenever questions of safety arise at any mine, the question shall be first discussed between the operating officials at the mine and the safety committee having jurisdiction at such property. In the event the questions raised are not resolved at this meeting or series of meetings, they shall be immediately referred to the district office on appropriate forms provided by such office. The designated forms will show: (1) The nature of the dangerous conditions, (2) the location and (3) the recommendations submitted by the safety committee to the mine officials for the elimination of the condition. Upon receipt of such complaint the district president shall immediately place it in the hands of the field worker responsible for the area in which the mine is located with instructions to attempt to resolve the controversy. If he be unsuccessful in his attempts, then he shall so advise the district in writing, together with his recommendations for adjudication of the matter. The district upon receipt of the field worker's report shall immediately transfer the file to the Safety Division for final adjudication.

5. Whenever a safety controversy reaches final adjudication through the intercession of the district, a report shall be submitted to the Safety Division of such adjudication, including copies of any agreements accepted as a means of settlement of the original controversy.

## Keeps Organization Fully Informed

The Safety Division has made it a firm policy to keep every segment of the organization fully informed of all activities. Its program in this respect is briefly outlined below.

The final report on all coal-mine inspections outlines in detail every violation of the Code found by the inspector, together with his recommendations for their abatement. This office receives copies of reports for all mines affiliated with our organization. Two copies are forwarded to the district office in which the mine is located, and the district in turn forwards one copy to the local union

having jurisdiction at the mine. Upon receipt of the reports by the Safety Division, they are studied and analyzed in accordance with provisions of the Code. A letter is then written to the management of the coal company calling attention to the findings of the inspector with a request that a report be submitted to the UMW Safety Division immediately, indicating the action which has been or is being taken to comply with the inspector's recommendations. A copy of this letter in every instance is sent to the local union having jurisdiction at the mine and to the president of the district in which the mine is located. The district office is requested to take such corrective action as it deems necessary, and the safety committee of the local union is requested to investigate conditions noted by the inspector, and report to the Safety Division the corrective action taken by the company. Several of our districts employ fulltime safety directors, and, in others, safety work is delegated to international representatives.

Accidents which result in death to our membership are investigated by the United States Bureau of Mines and a copy of their findings is forwarded to the Safety Division. Upon receipt of these reports a letter is written to the management of the coal company calling attention to recommendations made by the inspector for the prevention of similar accidents, and a copy of this letter is forwarded to the local union and the district. Although these letters are acknowledged and we are advised that corrective measures have been adopted, accidents resulting in fatalities reoccur and frequently from causes which have killed men in the past.

In an attempt to receive additional data through which our safety program may be strengthened, the Safety Division has initiated a program whereby all locals submit, through their recording secretaries, information on nonfatal, lost-time accidents.

Periodically circular letters are transmitted to the membership to acquaint them with recent developments in mine safety, and better and safer methods of performing work incident to the industry.

We also prepare three quarterly reports and one yearly report which are forwarded to the district offices. These reports include statistics on the number of inspections made for the period covered, the number of violations, safety improvements and repeat violations of the Code, the total number of fatal accidents which have occurred during the period, the total number of men who have been trained in accident prevention and the total number of Act violations, abatements, closing orders and annulments.

Our organization is actively engaged in all first-aid meets held in the various coal-producing states throughout the nation, and in addition is a co-sponsor of the National First-Aid and Mine Rescue Contest.

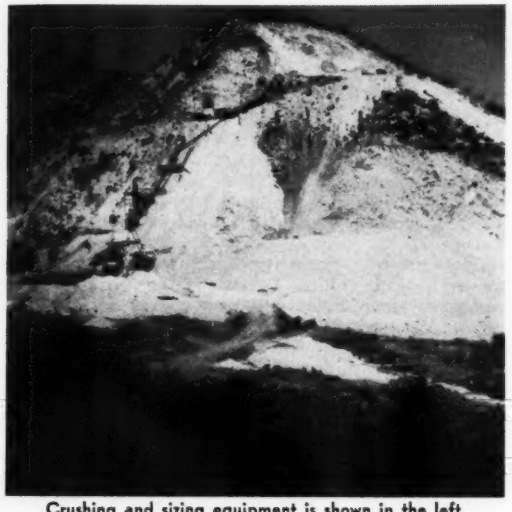
## Progress Being Made

The foregoing is a general outline of our safety program as it is carried on between the Safety Division and the districts and local unions. The cooperation we receive from various segments of the industry and our people is good, although there is room for improvement if we are to have a completely effective safety program. This again is a matter of education and an accomplishment which cannot be achieved overnight. The advances we have made in the past few years are anything but discouraging, and the matter of safety education is one in which progress is being made daily.

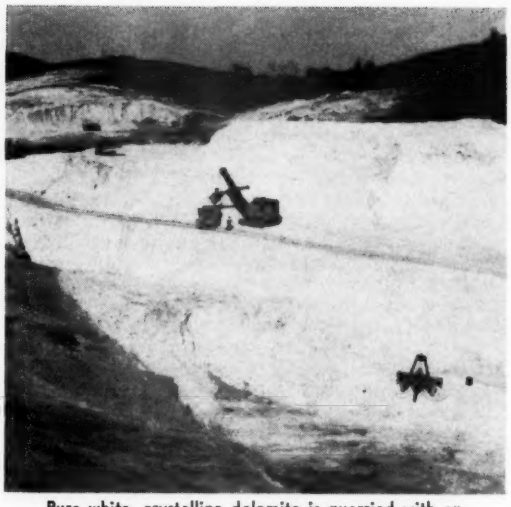
Our organization has one of the finest records for harmonious relations with correlated agencies, safety-wise. The record speaks for itself in terms of the existing attitude as it pertains to the state department of mines and the United States Bureau of Mines. This cooperation is inexpendable and without it all our efforts could not produce some of the results we can reflect on with a good deal of satisfaction at the present time. Any problem which arises in safety cannot be approached on an individual basis. Assuredly, different opinions from different individuals are healthful, but these opinions to be fruitful must and should be combined for the common good. In this respect, there now exists a down-to-earth, realistic attitude in safety matters between the United Mine Workers of America, Federal and state agencies and progressive segments of the industry. The cooperation we have given and the cooperation we have received has much to do with the advancement of our safety program.

At this point it should be noted that we are not satisfied with the accident rate of coal-mine fatalities, we are not pleased with the dispirited attitude of some segments of the industry in making coal-mining a safer occupation, we are not resting on our laurels in the field of safety legislation, and we have not yet reached that point in relation to our membership where we can relax our concerted efforts. About these matters we fully intend doing everything humanly possible to bring about improvements in this respect. Perhaps the pace of progress will seem snail-like, the setbacks numerous; but of one thing you can be certain, it must not take a recurrence of major disasters to make it crystal-clear to the industry that there will be no letup in safety education and all other aspects of the safety movement.

There is no statistical data included in this article. This omission was deliberate because those statistics are common knowledge throughout the industry. However, these statistics must give everyone grave concern, especially with two major disasters in the coal mining industry this year. We urgently request and plead for the cooperation of the industry in reducing this terrible toll on humanity and will stand ready and willing to aid and assist in every way that we possibly can.



Crushing and sizing equipment is shown in the left middleground of this view of L. H. Maddux's limestone quarry in Sheep Creek Canyon, San Gabriel Mountains, Calif. The principal product marketed is roofing granules but much of the rock is suitable for chemical use



Pure white, crystalline dolomite is quarried with an electric shovel at this operation of Westvaco Chemical Division, Food Machinery Corp., near Hollister, San Benito County, Calif. Little or no blasting is required as the rock has been naturally crushed in the San Andreas fault zone

# RECENT DEVELOPMENTS IN LIMESTONES, DOLOMITES AND CEMENT IN CALIFORNIA

By OLIVER E. BOWEN, JR.
**Senior Mining Geologist**
**California State Division of Mines**

**Oliver E. Bowen, Jr., is a graduate of the University of California at Berkeley in geological sciences. The past nine years of professional work have been as mining geologist with the California State Division of Mines at San Francisco where, as senior mining geologist, he heads the geologic mapping and commodity sections and is commodity specialist for limestone, dolomite and cement.**

**His recent publications include "Geology and Mineral Deposits of Barstow Quadrangle," Bulletin 165 of the Division of Mines; "Mines and Mineral Deposits of Mariposa County, California," in press at the Division of Mines; and the Cement and the Limestone and Dolomite sections of "Mineral Commodities of California," Bulletin 176 of the California Division of Mines, in press.**

NO one who has had everyday contact with the present seething activity in California manufacturing industries can have failed to be impressed by the importance and versatility of the industrial roles played by the carbonate raw materials limestone and dolomite. Blessed by numerous large and widely distributed masses of commercially acceptable carbonate rocks to draw from, California manufacturers have adapted them to so broad a variety of uses that the aggregate worth of the deposits to California industry is immense. During 1955 approximately 12,000,000 tons of limestone and a third of a million tons of dolomite were consumed by California industries in products worth more than $113,000,000 at the mill.

Because of the relatively low selling prices realized for carbonate rock products, their location with respect to markets and transportation is of prime importance. Thus far the only deposits remotely situated from markets and transportation that have been active contain types of specialty rock not obtainable closer in. All but a few of the active deposits lie within 125 miles of the marketing centers of Los Angeles and San Francisco. San Diego, however, is expanding so rapidly that it will have to be recognized as a third major marketing area in the near future and there is gradually awakening interest in such Central Valley markets as Sacramento and Fresno. The only factor likely to increase interest in the very large deposits of commercial limestone situated in Shasta and Siskiyou Counties would be a greatly accelerated public works program in the far northern parts of California and adjacent Oregon. There has been an intermittent trickle of limestone into Oregon from Siskiyou and Shasta Counties in recent years.

In direct contrast to the need for sources of supply located near to the marketing outlets is the formidable

The rock is white, dense, fine-grained and takes a high polish at this dolomite quarry near Columbia, Tuolumne County, Calif., operated by Sonora Marble Aggregates Co.

Packaging plant of Sonora Marble Aggregates Co. is located at Shaws Flat, Tuolumne County, Calif. This firm makes terrazzo chips for art concrete as well as roofing granules and other crushed rock products

**Items topping the current demand in California are new and better deposits of pure white limestone and dolomite for chemicals and fillers; iron-free limestone and dolomite for glass; non-decrepitating limestone of high purity for sugar refining; and colored carbonate rocks for terrazzo chips and roofing granules**

and increasing opposition to establishment of any sort of commercial enterprise near to the mushrooming residential centers. Cement companies and quarry operators in western Riverside County, southwestern San Bernardino County and Santa Cruz County, to name a few, have been vigorously opposed by residential property interests. Thus some of the better situated deposits of carbonate rocks may have to remain idle while some much less advantageously situated may become economic.

### Recent Trends in Demand for Limestone

There has been a continuous search during the past few years for better sources of pure white limestone of high purity for various filler purposes and for lime having a high degree of whiteness. Almost without exception the pure white limestones in California are coarsely crystalline rocks derived from colored limestone by contact metamorphism. Satisfactory deposits have been found in Santa Cruz, northern San Benito and northern Monterey Counties in northern California; in the Columbia and Porterville districts of the central Sierra Nevada; and in the Tehachapi, San Gabriel, San Bernardino and western desert ranges of San Bernardino and Kern Counties. Premium prices are paid for rock of a high degree of whiteness and calcium carbonate content and producers are willing to go farther from market for superior white rock than for most other types.

Like the market for white limestone there is constant interest in better and lower-cost sources of limestone for use in sugar refining. Refineries, particularly those employing the Steffen process of sugar manufacture, require rock that will hold its lump form during calcination. Such rock is none too plentiful in California because metamorphism of the limestones has resulted in coarsening the crystallinity and development of cleavage patterns that cause disintegration of the lump rock during firing. At present nearly all of the rock used by southern California refineries is shipped into California from Nevada because southern California deposits are either too remotely situated from transportation, are of insufficient purity, or else are controlled by companies who do not sell limestone on the open market. There are a number of idle California deposits in both northern and southern California which could be developed into active producers of sugar rock under proper incentive. Prices paid for sugar rock in California range from $2.80 to $4.50 per ton.

There has been increasing usage of both white and colored limestone and dolomites in California for use in terrazzo art concrete and a substantial tonnage has been coming into California from the southeastern states and from Italy. Uniform color, durability, uniform hardness, ability to take a polish and low liquid absorption are the principal factors governing suitability of a rock for terrazzo chips. Prices generally range upward from $19.00 per ton f.o.b. California rail shipping point.

One of the most rapid increases in demand for limestone and dolomite has been in the roofing granule industry, the bulk of the volume being in

white granules. Prior to 1940 production was only a trickle but in 1955 annual production reached over 63,000 tons. Most of the granules sold bring upward of $9.00 per ton f.o.b. the factory shipping point.

Another constant search is being made for limestone for glass where the iron content is the chief concern. Limestone having an iron oxide content in excess of 0.05 percent is unacceptable; rock having 0.02 percent iron oxide is demanded by some manufacturers and they would like a rock containing much less than this. Rocks this free of iron are rare in California but new sources may well be found. Prices range from $4.00 to $6.00 per ton.

Within the past year four hitherto unused deposits of limestone were brought into production. One uniform, high-calcium deposit in the Argus Range of southern Inyo County containing over 300 million tons was brought into operation by Westend Chemical Co. for use in manufacture of chemicals. Riverside Cement Co. recently began drawing from its Sparkhule Hill deposit near Oro Grande, San Bernardino County. This deposit contains well over 100 million tons of high-grade limestone. Permanente Cement Co. has developed several hundred million tons of limestone on its properties at Cushenbury Canyon southeast of Victorville and California Portland Cement Co. has activated deposits west of Mojave aggregating well over 100 million tons.

## Trends in Demand for Dolomite

Prior to 1942 dolomite was used only in small quantities in California as marble building facings, concrete aggregate, steel flux and glass sand. With the initiation of the use of calcined dolomite for manufacture of refractories by the Henry J. Kaiser interests in 1942, demand for dolomite rose sharply and annual production now exceeds 310,000 tons. Most of this is captive tonnage utilized in manufacture of magnesia refractories and chemicals. Production of these items has shown a steady, moderate increase in line with expanding industry in California. There has been a sharp rise in production of dolomite for roofing granules and terrazzo chips much as previously stated for limestone, as the two materials can be used interchangeably. There is a limited demand for dolomite having a very low iron content for use in manufacture of certain chemicals and for glass just as there is demand for iron-free limestone. New properties have been acquired by the operating companies in the northern Gabilan Range of San Benito County in recent years but none have been activated thus far.

## A Robust Portland Cement Industry

The modern portland cement industry in California began at Colton in 1895 although portland-type cement had been produced for short periods of time at Santa Cruz as early as 1877 and at Jamul Ranch, San Diego County, in 1891. Use of concrete increased slowly until 1902 but steady increases were recorded between 1902 and 1946 with the exception of the depression years of the 1930's and temporary wartime curtailments. Since 1946 production, prices, and plant capacities have all skyrocketed, and although present expansion and new construction programs are scheduled for completion by the end of 1957, there is no real indication the further expansion and planning for new plants will cease by that time. A few figures may serve to illustrate the foregoing points. In 1900 annual production of portland cement was 52,000 bbl valued at $121,000 at the mill. By 1946 production was 19,546,336 bbl valued at $32,403,181, but capacities, which were 25,770,000 bbl, far exceeded production. By 1955, production approximated 35,000,000 bbl worth $103,529,000, with production being about as near to the rated capacity of 35,508,000 bbl as it is possible to maintain. Under plans already announced, capacities will have reached roughly 47,000,000 bbl by the end of 1957. Capacities of half of the plants existant in 1946 will have doubled or more than doubled by that date.

The only new operators to enter the California portland cement industry in recent years did so by buying out operating companies. Outside interests have considered plants at Volcano, Amador County, Ojai, Ventura County, Palm Springs and Hemet, Riverside County, Cima and Amboy in the desert of eastern San Bernardino County and the Dos Cabezas and Coyote Mountains districts on the border between San Diego and Imperial Counties. There is also talk about a second cement plant in the Lucerne Valley area west of the Cushenbury Canyon site of Permanente Cement Co. Whether outsiders can successfully compete with companies which already have established markets remains to be seen. The Los Angeles and San Diego areas currently are attracting the most attention from outside interests.

One transaction may mark the beginning of a new era in cement operations. This is the purchase of Santa Cruz Portland Cement Co. by Pacific Coast Aggregates Co. There has long been a need for closer integration between cement-producing and concrete aggregate producing operations. In the past when there has been a structural failure in concrete some have laid the blame on the cement used, whereas others have maintained that that fault lay solely with unsuitable aggregate. Integrated operations which would include not only the production and preparation of the ingredients which go into concrete but the proportioning, mixing, and placement of the concrete on the job may well be in the offing.

## Some Future Public Works Projects for California

The *Engineering New Record* for July 12, 1956, gives the following breakdown on Federal-State public works construction over the next 5 years to July 1, 1961:

1. **Feather River water project, $870 million**
2. **State of California expenditures on flood control, $70 million**
3. **Corps of Engineers for flood control dams, etc., $440 million**
4. **Bureau of Reclamation—Trinity River, Central Valley, Solano projects, etc., $340 million**
5. **State buildings construction, $500 million**
6. **State aid for school building construction, $500 million**
7. **State veterans assistance in buying and building homes, $1 billion**
8. **State outlays for highways, $1.5 billion**
9. **Federal aid for highway construction, $500 million**

**Total, $6 billion**

The State Division of Highways estimates that California's part of the new Federal highway program will amount to 100,000,000 bbl of cement and 500,000,000 tons of aggregates over the next 13 years. The rate at which these requirements will be demanded is not yet known but the demand will not be evenly spaced over the 13-year period.

The federal airbase construction program in California includes $55,000,000 allotted in 1956 and about the same for 1957.

If all the dams proposed in the new California Water Plan are constructed, there will be 35 major structures and between 1000 and 2000 miles of aqueduct. The period over which these projects will be spread has not been announced.

From the foregoing figures it is easy to see why the construction industry and manufacturers that supply it are confident of future demand.

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# Preventing Stream Pollution

## An outline of the problems that face the coal industry in regard to water pollution

By HENRY F. HEBLEY
**Research Consultant**
**Pittsburgh Consolidation Coal Co.**

THE subject, "Preventing Stream Pollution," embraces all types of wastes that may be discharged to the stream system—municipal and domestic sewage, organic trade wastes, inorganic trade wastes, silt from soil erosion and temperature increase carried by discharged cooling water. Complicating all these various sources of pollution is the interaction of the different materials on each other and on the volume of stream flow itself. The proportion of one waste in relation to the others, the fluctuation in quantity and strength of each waste, the rate of discharge constant or fluctuating, intermittent or continuous, and the volume of flow of the receiving waters, high or low are all factors that influence the problem. The changing character of some of the wastes as the fashion of modern living changes adds difficulties. The increasing use of kitchen sink garbage grinders and the growing use of detergents in washing machines all discharging their material to municipal sewage modifies the calculations of the engineer designing the municipal sewage disposal plant.

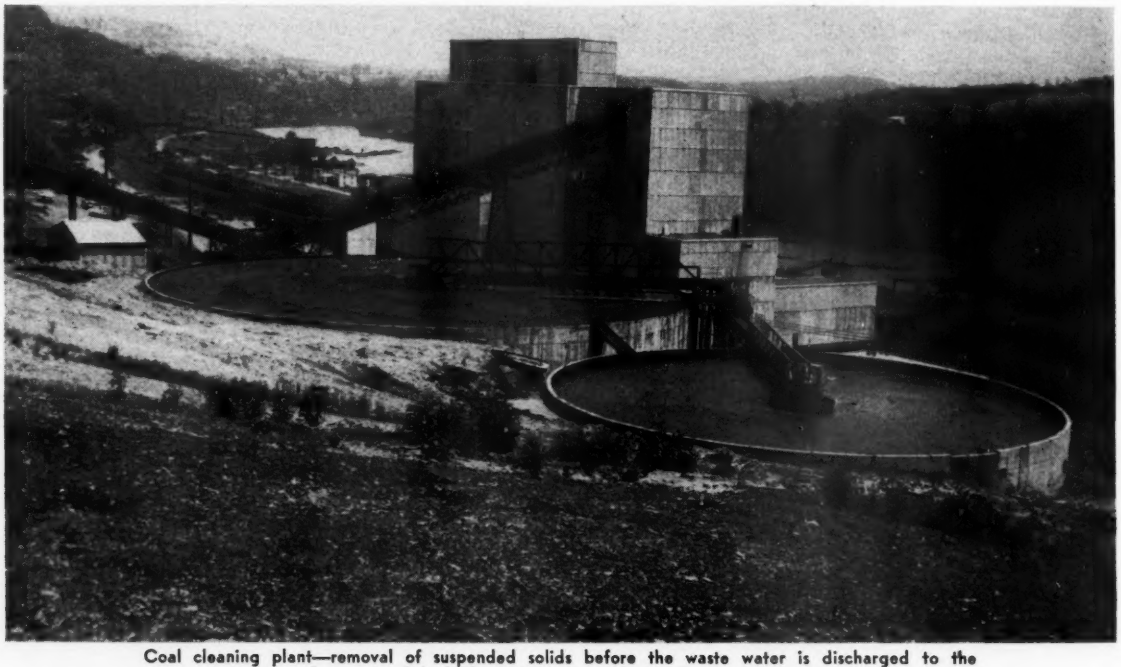
Roughly, the raw waste materials may be divided into two categories, namely organic and inorganic materials:

*Organic*

**Human sewage**
**Canning wastes**
**Cream and butter factories**
**Packing houses**
**Beet sugar plants**
**Distilleries**
**Breweries**
**Pulp and paper**
**etc. . . .**

*Inorganic*

**Metal mining and milling**
**Iron and steel**
**Coal**
**Coke**
**Non-metallic minerals**
**Petroleum**
**etc. . . .**



Coal cleaning plant—removal of suspended solids before the waste water is discharged to the stream system can be accomplished if provision is made in the design for adequate treatment

**TABLE I**

| Location | Period | % Est. Increase Population | % Increase in Water Consumption | Remarks |
|---|---|---|---|---|
| Baltimore, Md. | 1938-40 | 6.0 | 69 | Municipal |
| Baton Rouge, La. | 1937-45 | 6.0 | 78 | Municipal & Industrial |
| Detroit, Mich. | 1932-45 | 4.3 | 47 | Municipal |
| Galveston, Tex. | 1931-43 | 23.0 | 74 | Municipal & Industrial |
| Houston, Tex. | 1931-43 | 34.0 | 61 | Municipal & Industrial |
| Texas City, Tex. | 1931-43 | 63.5 | 2500 | Municipal & Industrial |

While there is a growing realization that radio-active wastes discarded by the atomic energy plants may in the future present one of the most serious and difficult disposal problems, so little is known of it at present that it is considered outside the scope of this article.

Referring again to the two broad divisions of wastes—organic and inorganic—it will be noted that the wastes created by the activities of the coal industry are inorganic in nature. Actually, the two major trade wastes that are encountered in the mining and preparation of coal are:

1. **Acid drainage water discharged to the stream system.**
2. **Suspended solids in the washery water discharged from coal preparation plants.**

These two pollutants will be discussed separately later in this article. In the meantime, it may not be amiss to consider the reasons underlying the rapidly growing demand on the part of the public for quality water. The agitation for control is quite strong at Federal, interstate, county and municipal levels. The reason is quite apparent to those familiar with the situation. In a few years the demand for water in some areas will exceed the supply. These rapidly growing requirements have been brought about by the phenomenal growth in population and the increased daily gallonage used by each individual, plus the heavy demand for quality water by new processes that were undreamed of 20 years ago.

As an illustration of the effect of industrial expansion on water consumption in various sections of the United States, Table I is given from the "Principles of a Sound Natural Water Policy," issued by the Engineers Joint Council in 1951.

One other case that may point up the local demands is the situation that is developing in the Potomac River Drainage Basin. Based on a study of the fluctuation in volumes of flow in the watershed, as well as the annual growth in demands for water, it has been projected that at the present rate of increase the demands will exceed the low flow volume of the river in 13 years. Conservation measures in the forms of impoundment can be installed, but for the time required for the necessary surveys for the selection of sites, design of the scheme and its construction, 13 years are barely sufficient.

An additional growing demand that has not been fully appreciated is the withdrawal of water from the stream system for use in the supplemental irrigation of acreage raising truck produce. Until recently, when irrigation is mentioned a picture of the 17 arid western states with their immense irrigation schemes came to mind. The humid eastern and southeastern states, with their 40 in. annual rainfall, had not thought it necessary to employ supplemental irrigation. However, the following figures indicating a trend may be of interest.

In 1953 American farmers spent approximately $45,000,000 for sprinkler equipment, while in 1954 they spent $55,000,000—an increase of nearly 22 percent. Most of this equipment consisted of portable pumps, piping and revolving spray nozzles. According to a recent estimate of the Sprinkler Irrigation Association, there are approximately 3 million acres of U. S. crop lands under sprinkler irrigation. While this is only one percent of the total harvested acreage, it represents a five-fold increase from the acreage sprinkled in 1950.

The foregoing figures indicate the change that is taking place. The farmer has found it is cheaper to install spray systems to supplement the rainfall than to lose a complete crop due to lack of rain. A trip through the truck farm area in northeastern Ohio, or through the asparagus acreage in southern New Jersey, will readily illustrate the extent of water withdrawal.

The users of waters may be divided into three main categories, namely—municipal or domestic, industrial and agricultural—and all are increasing their demands. Thus, the question of whose demands should be fulfilled and in what order is becoming increasingly urgent. This lesson is being brought home to a growing number of farmers in the eastern and southeastern states. The question of water rights and priorities is becoming of paramount importance. In most of the states east of the Mississippi River, the law of Riparian Rights prevails. Briefly stated, this philosophy allows any owner of waterfront land to use as much of the water as he needs, providing that he returns the water to the stream undiminished in quantity and unimpaired in quality.

Heretofore it has not caused much inconvenience because of an adequate supply, but now a number of the states sensing difficulty in the future have committees studying possible modifications in the law to cope with the rapidly changing uses and demands for water.

To the average coal operator such trends as have just been presented mean little. Concerned as he is with the production of coal, the cost per ton and the daily tonnage produced are vital factors that require his undivided attention and the problems of stream pollution are hazy matters far in the background and in the opinion of many a good place to leave them. When the problems are forced on the attention of the operator, in many cases it causes irritation and impatience to dismiss the subject as a disagreeable topic of conversation. Such an attitude is to be regretted, as there are many indications that time is running out. Other industries are being forced to install treatment plants wherever a method has been developed for processing their particular water borne trade wastes. Municipalities are also active in the treatment of domestic sewage. Considering the Ohio River itself, according to the Annual Report of the Ohio River Valley Water Sanitation Commission for 1956, in 1948 there were 230 municipalities adjacent to its banks that had virtually no sewage treatment facilities. Eleven places with only a total population of 22,000 were operating settling tank facilities. Today, 49 municipalities (population 450,000) have completed treatment plants, and 99 municipalities (population 2,600,000) have plants under construction. Summing it up, it may be

**Henry F. Hebley is recognized as one of the foremost authorities in this country in the fields of stream and air pollution. Born in Christchurch, New Zealand, he received his general and technical education there. Following World War I he worked for Union Pacific Railroad at Salt Lake City as a draftsman and designer. He then joined Allen & Garcia Co., specializing on steam and electrical requirements for mines, ventilation and coal preparation. During this time he served on two commissions to Russia and spent considerable time in Europe designing coal mine installations. In 1939 he joined Pittsburgh Coal Co. as product control manager and in 1943 was named director of research. He is now research consultant with Pittsburgh Consolidation Coal Co.**

stated that 85 percent of the 3,600,000 population adjacent to the banks of the Ohio River have sewage treatment plants in operation or under construction. Dominating these installations, of course, is the sewage treatment plant of the Allegheny Sanitary Authority which will serve 68 communities with a population of 1,270,660. Similar active construction of sewage disposal plants is being carried on in the watersheds of the following tributaries of the Ohio River: **Allegheny, Hocking, Muskingum, Scioto, Kanawha, Beaver, Wabash, and Green.**

The point of interest to the coal industry in all this activity lies in the fact that the funds required to defray the cost of this construction are raised through taxes paid by the populace. To pay for sewage treatment only to be faced with pollution from industrial sources will certainly cause increasing pressure to be brought on offenders. It has already done so.

Because of these growing demands that the trade wastes discharged from the operations of the coal industry must be curbed, it may be of advantage to present the problems and discuss the present practices that are employed to alleviate them.

## Acid Mine Water Drainage

As stated by Dr. S. A. Braley, "Drainage of acid mine water into surface streams of coal mining areas is one of the most serious problems of stream pollution, since there is no known method that completely prevents its forming and no economically feasible treatment after it has formed. The mine acid problem differs from other pollution hazards because acid production does not end with cessation of mining, but actually becomes more evident when pumping is stopped."

When it is recalled that mining in the Appalachian field started about the middle of the eighteenth century and has been carried on ever since, there has been an ever growing accumulation of sources of acid mine drainage discharging to the stream system. In fact, it is safe to say that the major portion of the acid water discharge comes from abandoned properties. Where the coal measures lie below the natural drainage level, it is possible to flood the abandoned properties and close off the supply of air, thus preventing the interaction of air and water with the iron sulphide (pyrite and marcasite) in the formation of sulphuric acid. It should not be assumed, however, that the formation of polluted waters from coal mine drainage is as simple as stated.

As pointed out by Dr. Braley, the percentage composition in mine waters vary over wide limits. Included in the usual dissolved substances are the following: **Ferrous iron, ferric iron, aluminum sulphate, calcium sulphate, magnesium sulphate, sodium sulphate, potassium sulphate, manganese sulphate, and chlorides.** A number of these dissolved chemicals adversely affect raw waters forming the supply for municipal water supplies. The common names for magnesium and sodium sulphates are Epsom salts and Glauber's salts respectively. If present in appreciable concentrations, they can cause dysentery. In the case of manganese sulphates, difficulty is encountered through the blocking of sand filters of public water treatment plants and in the spotting of laundry.

On the alkaline side, some mine drainage contains heavy concentrations of iron bicarbonate. This material may be noticed deposited as a brown coating of iron hydroxide on the beds of streams. It does not, however cause the stream to become acid.

Inasmuch as the various chemical reactions have been presented in complete detail in the reports on the research being carried out on acid mine water, they will not be repeated in this text.

Sufficient has been presented to indicate that the coal industry does have a problem in the discharge of acid mine water drainage. How can it be attacked? There are two approaches that can be explored:

1. **The acid forming material in the mine to be treated in a manner that acid formation will be inhibited.**
2. **If the formation of acid mine drainage has taken place, can the drainage be neutralized before the discharge reaches the stream system:**

Both methods of approach have been explored both in the laboratory and in the field. A treatment has been suggested whereby a coating could be placed on acid forming material in the mine which would prevent the air and moisture forming acid. Assume that such a treatment would prevent acid formation in the drainage water, how could it be applied in active mines where fresh surfaces are being exposed every day?

In abandoned mines with the ventilation discontinued and the pumps withdrawn and the continuous roof falls presenting fresh surfaces for the interreaction between air, water and pyrite, what method of application could be devised? It has been suggested that gaseous application may be employed by diffusing some neutralizing gas as ammonia through the abandoned property. This scheme has already been tried during the research work at Mellon Institute. It did not yield any tangible results. It is suggested that those skilled and experienced in mining, who know the movement of ventilating air and drainage within a mine, give some thought to possible methods of applying such a treatment to prevent acid formation.

Then there is the second method of attack—the use of an alkali mixed with the acid water drainage to neutralize it before it is discharged to the stream system. Lime is the material generally suggested, and theoretically it requires approximately a ton of lime to treat a ton of acid. The calcium sulphate formed would run about 1.35 tons. Some of this will stay in solution if the water is close to neutral. On the other hand, if the water becomes super saturated, some of the material will be thrown down with the iron hydroxide as a brown deposit or sludge on the banks and beds of the stream system. The water itself will be extremely difficult to handle in boiler plants because of the strong permanent hardness created by the calcium sulphate.

It has been suggested that settling ponds or lagoons be provided to settle out the sludge. Those experienced with these deposits know how difficult it is to handle this watery sludge when cleaning out the ponds. Then there comes the problem of sludge disposal. To discharge it on the land or hillside will only result in the material being washed back into the stream system by the 40 in. of average annual rainfall that prevails in the Appalachian region.

There is also an economic factor that has to be recognized in considering the treatment. According to the Report of the U. S. Public Health Service on the Ohio River Pollution Control supplement to Part Two (1943), the estimated annual amount of acid load at the confluence of the Monongahela and Allegheny Rivers is given in the following figures taken from Table Ac-1 on page 980:

**TABLE II**

| | Tons Per Year |
|---|---|
| Allegheny River | 405,150 |
| Monongahela River | 920,656 |
| Total | 1,325,806 |

The total annual production of lime in Pennsylvania, based on the 1953 Minerals Year Book was 1,335,000 tons. Thus, it would require practically the whole lime production of Pennsylvania to treat the acid load entering the Ohio at its source. Through the years, some doubt has been cast on estimates of acid load given in the U. S. Public Health Service Report, but it is as firm a figure as there is with which to work. It must be pointed out that although it may be uneconomic to treat the whole vast tonnage in this manner, lime for neutralization does serve a useful purpose in dosing pools of reasonable size that may be impounded in strip pits.

Another avenue of approach consists of impounding the acid laden mine drainage and releasing it in proportion to the volume of stream flow during periods of flood and high water, and using dilution as a treatment.

Naturally, the proximity of the mining operations to a stream of sufficient flow is one of the important factors. There is, however, one company in the midwest that cooperates closely with the Geological Survey. A stream flow gauging station is located close to the property, and when the flow reaches a certain stage, the water in the impounding areas is released under controlled conditions. The study of this problem has been going on for years, and a number of practical suggestions have been made that if carried out, would alleviate the situation. However, they must be put into practice by the operating departments of the coal companies.

The method of attack is easy to state. Remove the water from the mine as rapidly as possible to prevent the formation of acid through the reaction between air, water and pyrite or marcasite. To put this attack into action is extremely difficult. Actually, it will require new methods of thinking and the adoption of new methods of drainage control by the operating management. The following suggestions may be worth some thought.

(a) **A stream may have sufficient volume of flow to neutralize the acid water discharges, provided they are discharged at a uniform rate throughout the 24 hours.**

(b) **The period of time the water is held in the sump should be as short as possible.**

(c) **The distance of travel from the face to the sump should be as short as possible. This may require more sumps and pumps.**

(d) **It may be possible to use pipe or tile to conduct the drainage to the sump to avoid contact with pyrite.**

(e) **In order to discharge the water through a minimum length of pipe, bore holes placed at the most convenient locations may be necessary.**

All these suggestions mean increased cost in power, labor, material and maintenance as well as capital expenditure in sinking the bore holes.

At this point a slight digression may be in order. There are mines where the water may be alkaline in character and charged with iron in the ferrous state. This type of water is generally colorless at the point of discharge, but when subjected to aeration due to its movement along the bed of the stream as well as a rise in temperature from the heat of the sun, the iron further oxidizes to the ferric state and is thrown down as a brown deposit. In the popular mind this phenomenon is erroneously taken to indicate acid conditions. The waters are alkaline, but the deposit does blanket the stream bed tending to upset the aquatic life so necessary for the health of a stream.

A rather effective method of correcting this condition consists of accelerating the oxidizing processes by cascading the water to permit aeration and allowing the water to be warmed by the sun while slowly flowing over very shallow terraces. The final step consists of allowing the water to stand in settling ponds for the deposit of the iron hydroxide before the water is released to the stream system.

## Removal of Suspended Solids from Washery Water Discharges

The foregoing paragraphs have discussed the problem of acid mine water drainage. The other problem, water borne trade wastes discharged by the coal cleaning plants to the stream system needs some consideration.

The removal of suspended solids before the waste water is discharged to the stream system can be accomplished if provision is made in the design for adequate treatment. Generally, the flow-sheet of coal cleaning plants divides the feed into two sizes, namely coarse (that is, coal above ⅜ or ¼ in.) and fine (that is coal under ⅜ or ¼ in.). The water used in the washing process comes to the clarification equipment carrying particles of coal, clay and other sink material minus 28 mesh or 48 mesh, dependent on the size of opening of the wedge wire screen used on the dewatering screens. The treatment from this point can vary greatly and can employ various apparatus depending on different principles. Roughly, the equipment available is as follows:

**Drag tanks** — roughing machines eliminating the coarse particles through sedimentation with removal by a drag conveyor.

**Mechanical thickeners**—all-purpose machines eliminating the suspended solids through sedimentation with removal of the deposited solids by rotating rakes scraping the bottom of the tank.

**Settling ponds or lagoons**—a final device for permitting the effluent from other clarification equipment to stand quiescent for a period of time to permit gravity settlement. The deposited solids may or may not be removed.

**Refuse pile—settling ponds**—an all-purpose device made by arranging the washery refuse in such a way that the surface of the pile can be used as a combination settling basin and filter. The solids are strained out as the waste water passes through the piled refuse.

**Centrifuges** — machines equipped either with a perforated basket or a solid bowl that is rotated at high speed, thus separating the solids from the waste water through centrifugal force.

**Hydraulic cyclones**—machines varying from 15 to 3 in. which bring about a separation of the solids from the waste water through a combination of pressure and centrifugal force.

**Vacuum filters**—secondary machines for removal of water from the thickened underflow from mechanical thickeners. They depend on a vacuum being applied through a porous surface with an arrangement for cracking off the cake from the porous surface at a certain point in the cycle.

**Settling cones**—roughing machines that serve a dual purpose of providing the necessary hydrostatic head on the coal cleaning equipment and removal of particles through sedimentation.

With so many types of equipment available for incorporation in the flow sheets, it is but natural that the arrangements should vary greatly and become complicated. However, in principle they follow the flow from "roughing" equipment to dewatering screens with say ⅛ or 1/16 in. openings. The coarse material is sent to centrifuges while the undersize is sent to hydraulic cyclones, thence to thickeners and finally to lagoons.

The whole intent of the treatment consists of removal of sufficient suspended solids to satisfy the water control boards of the various states and interstate compacts. Some of the states are further advanced than others. Some have adopted numerical figures for the quantity of solids in the effluent; some go by appearance. Probably the most advanced specifications that have been suggested for the control of solids are those adopted by the Pennsylvania Sanitary Water Board. Briefly, they are as follows:

**Solids in the effluent not in excess of 1000 parts per million (0.1 percent).**

**Upward velocity in thickener—three ft per hour.**

**Period of retention in thickener —not less than one hour.**

**Depth of thickener at the side—nine ft.**

If these criteria are adopted throughout the Ohio River Drainage Basin, it will be necessary for a number of the coal preparation plants to modify their coal clarification systems.

The State of West Virginia has adopted a different approach. It is treating the reduction of pollution on an individual watershed basis. Tentatively, it has set as an objective "to require at least sufficient treatment to provide substantially complete removal of settleable solids and removal of not less than 45 percent of the total suspended solids." This requirement is probably taken from the specifications that have been set up for

the treatment of domestic sewage which involve the reactions of an organic nature. It may not be applicable to solids discharged with water from a coal cleaning plant.

To date, Ohio, Kentucky, Indiana and Illinois have not adopted rigid quantitative requirements.

From the foregoing comments, it will be seen that the various segments of the coal industry located in the Ohio drainage basin have no uniform measures for comparison.

Then there comes the question of sampling. As far as can be learned, there has never been any consistent method suggested for the collection of the gross sample for the determination of solids carried by washery water effluent. This problem has been considered by the Metal Finishing Industry Action Committee to the Ohio River Valley Water Sanitation Commission (ORSANCO) and has mentioned a number of points that should be considered in any sampling:

"Degree of variation in rate-of-flow determines the time interval of sampling. This interval must be short enough to provide a true picture of the flow. Even when there is little variation in rate-of-flow, concentration of contaminants may vary widely. Frequent sampling permits determination of average concentration during period of sampling. The time interval between taking samples should be 10 or 15 minutes. Sampling results may demonstrate that a longer interval can be used but it should never exceed one hour—and it should always be uniform. Unless you get a truly representative sample your efforts will be wasted.

"A grab sample is a manually collected single portion of the waste. An analysis of a grab sample shows the concentration of the constituents in the waste at the time when the sample was taken.

"The volume of individual grab samples will depend on the volumes required for the analyses to be made. If the grab sample is to be composited, the volume collected must be more than needed for the proportional part of the composite sample.

"When rate-of-waste-flow is variable, volumes of the several samples are mixed together in proportion to flow. This is done to provide a composite sample representative of the waste discharged.

"Sample volumes must be proportional to rate-of-flow of waste. If a composite sample is collected during a 24 hour period, the total volume of waste in the sample must represent the total volume of waste being discharged.

"Size of sample should be determined after a check on measuring rates-of-flow. The composite sample gives a weighted average of the amount of waste, if the size of the sample taken at each measurement of rate-of-flow is proportioned to the rate-of-flow."

From a practical point of view, ORSANCO has suggested the following method that may be suitable for the coal industry to collect the sample provided the flow is not too heavy:

"Bucket and stopwatch—In this method the time required to obtain a given volume of water in a container is measured. The volume in gallons is first determined by measuring the weight of water in pounds (weight of bucket and water minus weight of bucket) and then dividing by 8.3 (one gal of water weighs 8.3 lbs). Weight is preferable to nominal volume of a bucket since such volume is rarely accurate.

"Time required for filling the bucket is determined by stopwatch. A watch with a good second hand would do as well as a stopwatch. The flow in gallons per minute (gpm) is then calculated.

"This method should be applied to sewers or outfalls where free fall occurs and flows are small. If the container fills in less than ten seconds, the accuracy is questionable."

The determination of the solids is the next step. For practical work the sample should be filtered through an ordinary dry filter paper and the solids retained on the filter paper dried at 103°C and weighed. Where solids in the effluent are running five percent (50,000 ppm), the usual Fisher Scientific Co. Bench Balance generally found in washery control laboratories will be sufficiently accurate for the method of sampling employed. When the solids have been reduced to the level where they are reported in thousands of parts per million (8000 ppm or 0.8 percent—5000 ppm or 0.5 percent), the more sensitive analytical balance should be used.

The foregoing procedure may take considerable time and be rather tedious, however one can use a Denver Equipment Co. pressure filter having a 10 by 12 in. cylinder. One such filter costs $166.00 plus $6.00 freight, Denver to Pittsburgh. This cost is quite nominal and is worthwhile in reducing the time of filtration.

The methods outlined are only suggestive in order to introduce the subject of determining the facts. The need for facts is most critical, and it would be of advantage if they were all collected on a uniform basis employing the same procedures. Useful comparisons can then be carried out. There is no doubt that the need for these data is urgent as a serious situation exists. In analyzing the numerous "cease and desist" rulings that are made on different coal producing operations by the sanitary water boards, it is remarkable how at the hearings so many companies have no information nor facts and figures to present regarding their performance. What is known by all concerned, however, is the fact that there are numerous plants that are "slugging" the streams periodically by discharging the underflow from settling cones and sludge tanks to the stream system. Granted that many plants have a settling and water clarification system embodying drag tanks, classifiers, mechanical thickeners, hydraulic cyclones and other equipment arranged in various flow-sheets, still the emphasis is generally on obtaining a satisfactory overflow from the settling tank or cone (say water carrying five percent solids—50,000 ppm) for return to main water supply to the washery circuit. What is discharged to the stream system receives little consideration. In the near future, however, the quality of the water discharged from the cleaning plants will become of prime importance and it would be showing good judgment to be fully informed beforehand on the problem that has to be met. The methods employed for attaining satisfactory settlement of solids and clarification of the effluent is only of mild interest to the regulatory bodies. Their chief concern is the results attained. One point of interest, however, may be mentioned which indicates a trend in coal cleaning plants. In practically all the plants in the anthracite field that have yielded results satisfactory to the Sanitary Water Board, no matter what the treatment of the water for the removal of solids, the final step is the provision of a settling basin or lagoon. At plants located in hilly terrain the objection is voiced that there is insufficient suitable area to provide basins. To help in the acquisition of such areas, both Pennsylvania and West Virginia have granted the "right of eminent domain."

Another factor needs to be recognized, namely the presence of collodial clay with the fine particles of coal. Such clay can create a very difficult settling and water clarification problem. In some cases this situation has been overcome through the use of flocculants—lime and caustic starch having been used for a number of years in one preparation plant. It is interesting to note that research on flocculants and their uses is being carried on at Mellon Institute of Industrial Research. With increased demand for water treatment, it is quite possible that treatment with flocculants will come into more general use.

The foregoing provides a general sketch of water pollution problems that face the coal industry. It is to be hoped that those of the industry who have pollution problems will make a new survey of their individual situations and take steps to alleviate conditions.

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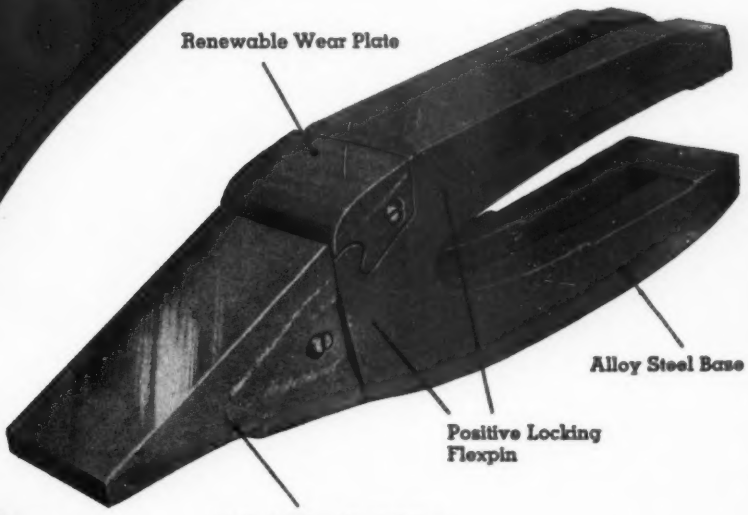


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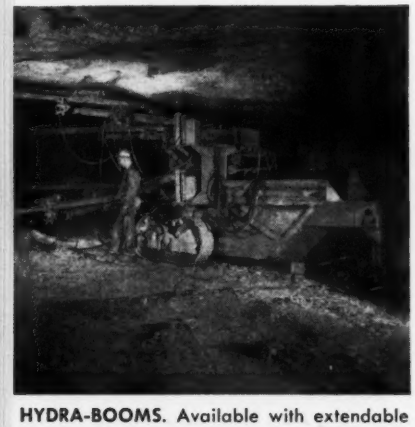

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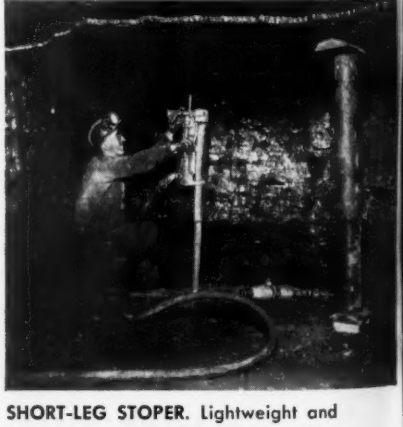

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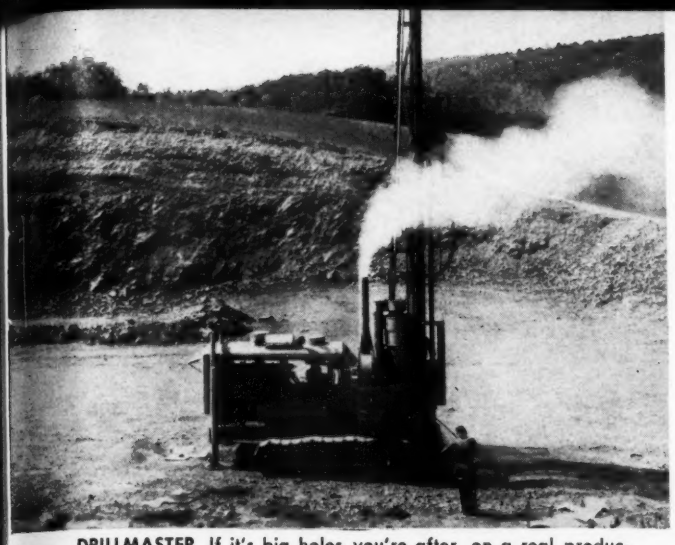

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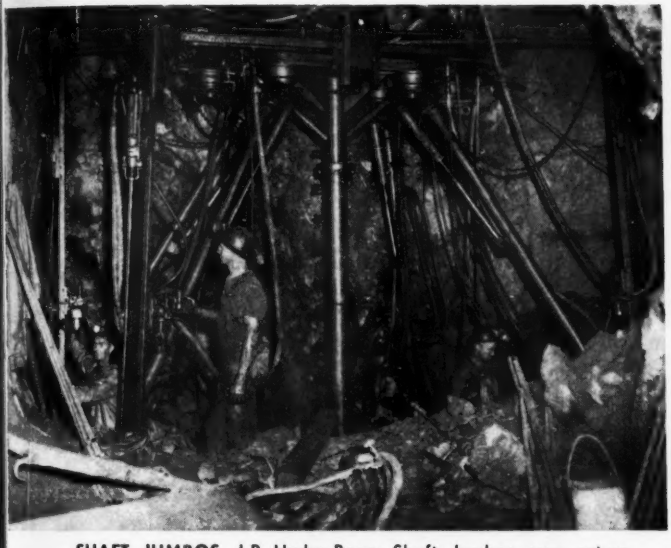

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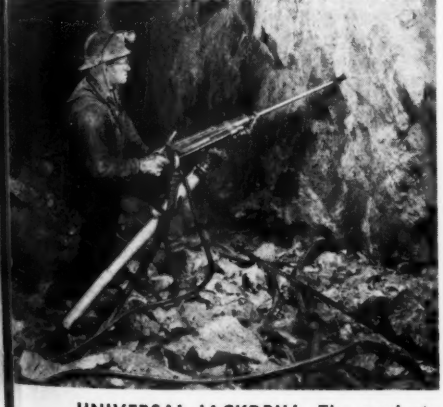

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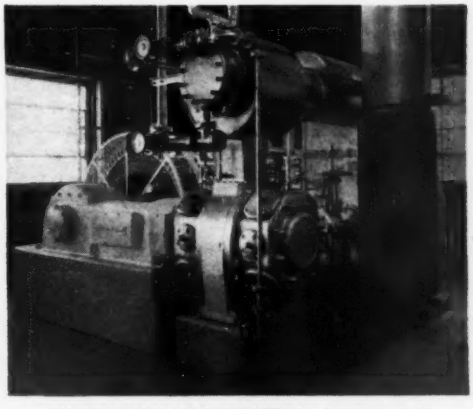

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An engineer outlines the factors that are most important in supporting heavy ground around active stoping areas, providing data to illustrate the serious effect of ground movement on costs and ore grade. He also discusses proper draw control—another angle of attack in fighting weight

# Support of Heavy Ground In Bulk Mining Operations

By J. W. STILL
**Consulting Engineer**

IN most large tonnage operations using the caving system of mining, weight in the active stoping areas is almost certain to be a continuous and expensive problem. The only exceptions are Climax and International Nickel where, fortunately, the rock strength is such that weight is no great problem. Weight generally effects the draw lines and service fringes under or immediately adjacent to the areas undercut and, in a lesser degree, the underlaying transfer raises or haulage levels where they lay less than 50 ft vertically under the draw level.

## Timber, Steel or Concrete?

There are no two caving operations exactly alike, nor generally in any one mine is the weight condition the same over the entire mining area. Costwise it is difficult to exactly say in any one operation whether timber, steel, or concrete is the cheapest in the long run. Numerous factors such as variations in the rock strength, height of ore to be mined (which governs the length of time the stoping area must be kept open), the manner in which the rock caves (fine or rough) and the speed of the draw possible, all have a bearing. In addition to these factors are the year by year labor cost rise and the everpresent shortage of skilled timbermen-repairmen.

There is also another factor that can be extremely important, and that is the manner in which the weight is fought. Generally the weight that caused the drift failure will, if given a little more time, pack the broken rock back almost to its original in place condition. For this reason, if tonnage demand will allow it, leaving the spot lay for a week or ten days will make the repair job much easier. Weight will also occasionally come in short surges, perhaps splintering and deforming the timber or steel to where the drift looks rough but is still perfectly safe. At this point the weight may ease off and never recur again in the same spot; thus too quick a repair job in such areas may be wasted effort. These factors are of course a matter of local judgment based on past experience in the particular mine, but they do effect the maintenance costs.

When all of these factors are combined, it would seem that the strongest original installation, if it can be had at not too excessive a cost, would prove the cheapest overall. This conclusion, buttressed as it is by the generally good recent experience had at the various operations, points to steel or concrete or a combination of the two.

The Bethlehem mine at Cornwall, the Cleveland-Cliffs Mather mines, the Kelley at Butte, the old Miami Copper, the new San Manuel, and the asbestos mines in Quebec all have a weight problem that in each case is probably their single biggest operating headache. The open pits at Ray and Inspiration were conversions from earlier underground caving operations, and it is probable that weight (plus the fact that the orebodies permitted it) had something to do with the decision to convert.

In addition to the actual cash costs of repairs due to weight, and the generally forced unhandy operating procedures resulting therefrom, there is a sizable adverse economic effect on tonnage and grade extraction. This naturally results from the forced erratic draw, when weight conditions in part of a stope, or all of it, become so bad that the only choice is to get out as best you can. Always as stope maintenance costs go up, other costs also go up, and results grade and extraction wise go down. To illustrate the magnitude of the possible mining loss under the worst conditions, the accompanying table shows Miami experience over 55,000,000 tons mined on 1000 level lift, this data being taken from a paper the author prepared for the 1954 meeting of the American Mining Congress in San Francisco.

Obviously, with such a problem, there has been a continuing and strenuous effort at all of the operations to seek some better means to combat weight. Climax has long used concrete,

**J. W. Still attended the University of Arizona. His broad experience includes working at Miami Copper as rodman thru stope engineer, 1922-1930, and four years as mine superintendent at Bagdad Copper. After a short hitch in the Philippines and at Phelps Dodge Corp. at Ajo, he returned to Bagdad as assistant manager and general manager. He spent 1½ years in Washington, D. C., on war metal purchasing with MRC and FEA. Since mid-1945 Still has been associated with Miami Copper as mine superintendent and general superintendent.**

**Table Showing Magnitude of Possible Mining Loss Under Worst Conditions***

| Labor on stope repair-tons per manshift | Weight condition | Repair cost per ton | Number of stopes | % tonnage drawn | Extraction %'s | | |
|---|---|---|---|---|---|---|---|
| | | | | | Tons | Grade | Copper |
| 300 plus | Little | $0.044 | 12 | 21.5 | 120.6 | 93.2 | 111.9 |
| 300 to 100 | Average | 0.121 | 44 | 72.9 | 111.9 | 94.3 | 105.5 |
| under 100 | Heavy | 0.323 | 9 | 5.6 | 85.3 | 85.6 | 73.1 |
| Totals and Averages | | $0.115 | 65 | 100.0 | 111.6 | 93.4 | 104.3 |

* Miami experience over 55,000,000 tons mined on the 1000 level lift.

not primarily for ground support, but for abrasion resistance. The asbestos operations started with steel, this being due to the necessity for keeping their ore wood free, and they are now using both steel and concrete. Over the past eight years all of the other caving operators, borrowing at least in part from Climax and Quebec, have experimented with either steel or concrete, or both. In 1948-49 the Mather A mine started the use of post and cap type steel sets, later went to circular steel sets and are presently using both the yieldable type circular steel and concrete. At about the same time, or a little earlier, the Bethlehem Cornwall operation went extensively to concrete, both in the draw lines and on the haulage level, with good results. It is believed that they are now extensively using the yieldable circular steel sets. In mid 1950 Miami started using circular steel, the results being such that this steel is now standard. The Kelley mine went quickly from timber to steel, and from steel to concrete, with cost results that indicate concrete is the answer in its case.

## Proper Draw Control

While this paper is a discussion on "Support of Heavy Ground in Bulk Mining Operations," **there is another angle of attack, for regardless of the type of support used, the best way to fight weight is proper draw control.** This is of the utmost importance at the time of the undercut and for the first 10 to 15 per cent of the draw, for it is almost always at this stage that the weight hits.

Two things are absolutely necessary to achieve proper draw control. First, the most important, is that on all levels of supervision the logic and concept of the caving action must be thoroughly understood. Second, regardless of cost or tonnage demands (which will take care of themselves later) the top supervision must insist on an exact and proper procedure during the undercut and for the first 10 to 15 percent of the draw. The following steps will start a stope off right and go further than anything else to insure good costs, grade and tonnage extraction.

The preparation and line up on the undercut should be so planned that it can be completed as fast as possible. As each draw hole is blasted down it should be pulled either empty or a tonnage equivalent of eight vertical ft. This generally requires extra blasters and cleans out the scrap undercut timber. Subsequently, through the three to six weeks until the entire stope is undercut, these early chutes should be moved regularly enough to prevent packing (50 to 100 tons per week) and the normal tonnage demand taken only when the undercut is completed and all draw raises ready for production. Almost always the first five to ten percent of the stopes expected tonnage will draw rough and considerable secondary blasting will be required. During this stage the best draw bosses available should be put in the stope, as many men given them as can be beneficially used, and no excess tonnage quota be expected. On top of all this all other supervision, stope engineers, foremen, general foreman and superintendent, should give the new stope special attention. This proper procedure will start the stope off right, provide an increasing and fluid cushion of broken ore, and result in the maximum stress and strain action in the caving arch. The above may sound like a lot of work, but it is worth it, for besides insuring a stope's maximum performance, the emphasis placed on draw control at this point, stope by stope, is a continual education to all levels of the supervisory and engineering force.

**Cost results at the Anaconda Company's Kelley mine indicate that concrete is the answer to its support problem**

# DESIGN OF MINE ROOF BOLTING SYSTEMS

## Report of AMC Committee on Roof Action outlines method for scientifically determining best roof bolting pattern

By E. H. JOHNSON and
L. A. PANEK

IT is now well known that laminated strata overlying coal beds can be reinforced for supporting the roof over working areas by tying these laminations together with roof bolts. It is just ten years ago that this practice was first described at the annual conference of the AMC Coal Division, by C. C. Conway. It is not necessary to elaborate on the advantages of such reinforcement. No innovation in coal mining has developed more rapidly than the use of steel bolts for holding the roof in place while the coal is extracted.

This development has resulted in greater safety for mine workers and this factor is the chief advantage sought by use of this method of roof support.

In the period during which roof bolting was developed into common practice, certain standard methods of use were developed by coal companies, with the aid and cooperation of State and Federal safety men. The elimination of rigid supports from floor to roof was such a drastic step that great caution had to be employed for protection of men exposed to the hazard of roof falls. It was recognized that great variations in physical character of overlying strata exist from mine to mine, from bed to bed, and even from one mine section to another. Therefore, whatever errors were made in estimating requirements were cheerfully made on the conservative side. Roof falls still remain the number one hazard for underground workers and the frequency and severity of the injuries that occur are greatest in conditions of fresh exposure of the roof. We can say that use of this type of roof support has been and is a great advance in mine safety.

The uniform patterns of roof bolt installations that are in general use have evolved from the situations described above. Sometimes we have used more bolts than are necessary, and the bolting pattern adopted is not always best suited to the conditions. So we find it important to approach this question from a scientific angle to replace the rule of thumb.

A start was made in this direction by the Roof Action Committee in 1954 and we are indebted to Robert Fletcher for a preliminary report he made for the committee in October 1954. This report gave several illustrations of the value of pattern changes that have improved the efficiency of support in Ohio and Pennsylvania mines while reducing the cost of bolting, chiefly by staggered bolt positioning. Then, in March 1956 the U. S. Bureau of Mines published three reports of Investigations, No. 5154, No. 5155 and No. 5156, by Dr. Louis A. Panek; "Theory of Model Testing as Applied to Roof Bolting," "Design of Bolting Systems to Reinforce Bedded Mine Roof," and "Principles of Reinforcing Bedded Mine Roof with Bolts." These reports comprise a truly scientific approach to the problem of reinforcing roof with bolts, and are a valuable contribution to the further understanding of roof action.

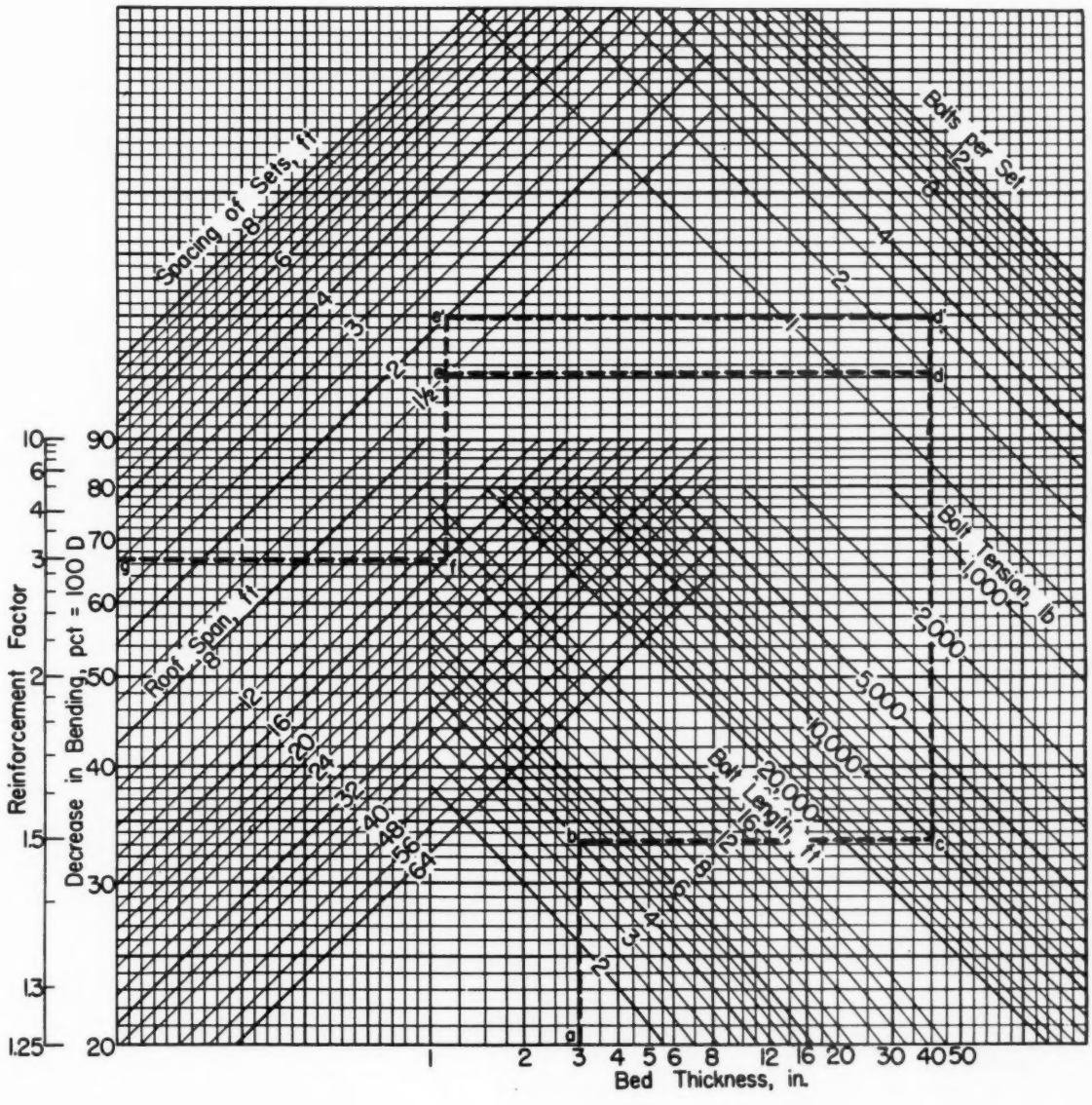
In any given condition of stratified mine roof, we learn by experience how much exposed area will be supported by its own inherent strength. When we use posts or cross bars or bolts, we use the support to reinforce the inherent strength of the roof so that the likelihood of failure is decreased. The ratio of the roof strength after it is reinforced to the inherent strength of the roof can be considered the reinforcement factor—a term that is important in the following discussion. If the roof we are concerned with is good we may need a reinforcement factor of 1½ or perhaps 2. On the other hand, if the roof is weak, we may need a much greater reinforcement factor.

In R. I. No. 5155, Dr. Panek has shown a roof bolting design chart by which it is possible to determine the reinforcement factor and the following is excerpted from his reports.

### To Design a System

The method of designing bolting systems to reinforce horizontally bedded roof presented herein, is based on results of model tests that are described in detail in References 1 and 2. By use of the roof bolting design chart shown in figure 1, a general procedure can be followed for the designing of a roof bolting system. The following factors enter into this design:

(a) Average bed thickness of mine roof
(b) Length of roof bolts
(c) Bolt tension and anchorage capacity




Submitted by L. A. Panek
1956

(d) Number of bolts per set across the entry or room
(e) Spacing of the sets along the entry or room
(f) Width of roof span
(g) Reinforcement factor—percent decrease in roof strata bending

A general procedure for designing a bolting system by the Roof Bolting Design Chart follows:

1. Take the average thickness as a first approximation for bed thickness. This can be determined by measuring the thickness of an exposed roof section and dividing by the number of laminae included in the section. "Bed" is used primarily in a mechanical rather than a geological sense; that is, bed thickness refers to the thickness of the individual laminae or layers that form when the roof bends. A shale stratum, for example, may split into a number of thin beds or laminae.

Use of the average lamina thickness results in conservative design. When laminae several times as thick as the average are present in the bolted thickness of roof, the reinforcement factor is greater than that given by the present chart, which applies specifically to roof in which all laminae are of equal thickness. (USBM tests now in progress will result in appropriate modification of the design chart to take this factor into account and will permit evaluating also the case in which weak or thin laminae are suspended from a strong or thick bed.)

2. Choose a bolt length that will assure firm rock at the anchorage horizon (may depend on item 3).

3. Perform tests (References 3, 4, 5) to determine the bolt anchorage capacity. Choose as the design value for bolt tension either the anchorage capacity or the following, whichever is smaller: 10,000 lb for a wedge-type, one-in. mild-steel bolt, 8000 lb for a shell-type, ¾-in. mild-steel bolt, 8000 lb for a shell-type ⅝-inch high-strength steel bolt, or 6000 lb for a

shell-type ⅝-inch mild-steel bolt. (These values provides a margin of strength for the bolts. Although these bolts can take greater loads in a testing machine, tension in a bolt installed underground is derived by torquing the bolt, which in turn reduces the load the bolt can take in tension. As the diameter of the bolt is reduced, torque plays an increasingly important part in reducing the tension that can be applied.)

If it is found that significant loss of bolt load occurs after installation, this lower value of bolt load should be used in design. For examples, if bolts installed at recommended torque are found to have a load of only 5000 lb one month later, the design value of bolt tension should be taken as 5000 lb even though the installation tension may be (say) 8000 lb.

4. Choose the number of bolts per set so that the spacing of bolts within sets (roof span divided by one plus the number of bolts per set) is not excessive. For most coal mines the maximum safe distance between bolts may be estimated at four to six ft.

The minimum number of bolts per set can best be established by experience for any given mine, because it depends on the prevalence of fractures, kettle-bottoms, and other local roof imperfections that could cause falls between bolts. A logical procedure would be to decrease the number of bolts per set by steps, each time decreasing the set spacing as required by the design chart to keep the reinforcement factor unchanged.

Spacing of bolts within a set is not critical, but for practical reasons an approximately equidistant spacing (bolt-to-bolt, and bolt-to-rib) is recommended (Reference 1).

5. Choose a trial value for spacing of sets of bolts (along the opening) not greater than the spacing of bolts within sets (across the opening).

6. Using the desired roof span, construct a-b-c-d-e-f-g on the design chart. The shorter the roof span the greater the effectiveness of bolting: bolts are not an efficient substitute for pillars.

7. If the reinforcement factor is less than two, (a) decrease the set spacing and/or the roof span, and/or (b) increase the number of bolts per set and/or the bolt length. A change in (a) will have a greater effect than the same percentage change in (b).

Results achieved in bolting a particular roof should indicate whether the existing reinforcement factor, as determined from the design chart, is adequate or should be increased by modifying the bolting system in use. In the absence of previous experience in bolting a given roof, a reinforcement factor of two is proposed as a minimum, to justify roof reinforcement by the bolting method.

At this point it should be emphasized that use of the Roof Bolting Design Chart does not provide information as to the absolute strength of a particular bolted roof. Instead, it reveals how much that roof is strengthened by the use of a particular bolting pattern.

| Bolt Length | Bolts Per Set | Spacing of Sets | Per 100 ft Along Opening Number of Bolts[1] | Feet of Steel[2] |
|---|---|---|---|---|
| 4 ft | 2 | 1½ ft. | 133 | 532 |
| 4 " | 3 | 2 " | 150 | 600 |
| 5¼ " | 3 | 2½ " | 124 | 651 |
| 4 " | 4 | 2½ " | 166 | 664 |

[1]Bolts per 100 ft = 100 x Bolts per set ÷ spacing of sets.
[2]Feet of steel per 100 ft = Bolts per 100 ft x bolt length.

Table I.—Comparison of four different bolting systems for a given roof. Span—16 ft, bed thickness—3 in., bolt tension—10,000 lb, reinforcement factor—three

Conversely, if the existing bolting system is judged to be effective from the roof support viewpoint, the Roof Bolting Design Chart may be used to devise a bolting system that is less costly but equally effective, as illustrated in the examples given below.

## Example Showing Use of Chart

By use of the Roof Bolting Design Chart, one can determine, for example, that a roof reinforcement factor of three is achieved by bolting, if (a) the roof beds are three in. thick, (b) the bolts are four ft long, (c) the bolt tension is 10,000 lb, (a wedge-type one-in. mild-steel bolt is to be used), (d) there are two bolts per set (across the opening), (e) the sets are spaced at intervals of 1½ ft (along the opening), and (f) the roof span is 16 ft which (g) decreases the roof bending strain by 67 percent. Since only 33 percent of the bending strain remains, the effect of bolting is to triple the safety factor of the roof, which is expressed by stating that the reinforcement factor equals three.

The corresponding points a-b-c-d-e-f-g are shown on the design chart. Notice that the bolting system represented by a-b-c-d-e-f-g with three-bolt sets and two-ft set spacing, provides the same reinforcement factor for the same roof. These two bolting systems are listed in Table I, lines 1 and 2; two other bolting systems for the same roof are given, lines 3 and 4. Other things being equal, choice of bolting system can be based on cost. For example, considering the four bolting systems in Table I, the first and third methods require the least number of bolts and therefore have the lowest labor (installation) cost. However, the first method is better than the third because it requires much less steel and therefore has a lower materials cost.

If it is possible to maintain a tension of only 5000 lb in the bolt because of anchorage capacity, the chart shows that the first pattern described above would give a reinforcement factor of slightly more than 2.1. To obtain a reinforcement factor of 3 with a 5000-lb bolt load, the bolting scheme would have to be changed, as described under item 7 above.

EDITOR'S NOTE: An 8½ x 11 reproduction of the Roof Bolting Design Chart is available from MINING CONGRESS JOURNAL upon request.

### References


1. Reinforcing Bedded Mine Roof with Bolts, USBM R.I. 5156–1956.
2. Design of Bolting Systems, USBM R.I. 5155-1956.
3. Anchorage Testing of Roof Bolts, Slotted-Type, USBM R.I. 5040-1954.
4. Anchorage Testing of Roof Bolts, ¾-inch Expansion-Type, USBM R.I. 5194-1956.
5. Anchorage Testing of Roof Bolts, ⅝-inch Expansion-Type, USBM R.I. 5310-1957.

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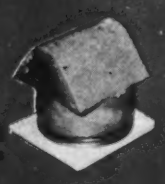
Rocker-arm casting, two bronze washers and base plate casting which are welded to IRWIN four-wheel trucks. Casting is designed so that large washer bears on the flat machined surface while smaller washer bears on raised portion.



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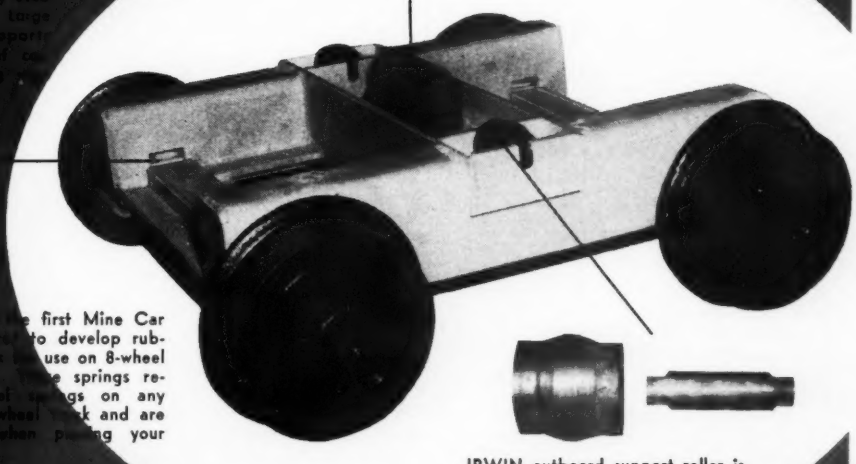

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# Wheels of GOVERNMENT

AMC

## As Viewed by HARRY L. MOFFETT of the American Mining Congress

The prolonged debate over civil rights legislation has stymied action on major measures pending on the Senate calendar. Most observers believe that little other than appropriations bills will be approved during the remainder of the current session.

An air of compromise now exists in the Senate over civil rights, and it appears that a watered-down version of the House-approved bill will be adopted by the upper chamber without a filibuster. As a result Congress will probably adjourn in late August rather than at the early October date predicted at the outset of the civil rights debate.

While floor action on the Administration's proposals has virtually halted, Committee consideration of numerous bills of major import continues and the path will be clear for quick action on many measures early in the next session. To date, Congress has acted upon only 32 of the President's 203 legislative requests.

### LEAD-ZINC IMPORT TAX HEARINGS HELD

As this issue goes to press, the Senate Finance Committee has concluded hearings on the Administration measure, co-sponsored by 14 Senators, which would impose sliding-scale excise taxes on lead-zinc imports. This bill, part of the long-range minerals program recommended by Interior Secretary Seaton, would remove present import duties on lead and zinc and establish the following excise taxes: As to *lead*—when the price is 17 cents per pound or more, no tax would apply; 16 to 17 cents, a tax of 1 cent per pound; 15 to 16 cents, 2 cents; and 15 cents or less, 3 cents; as to *zinc*—when the price is 14½ cents per pound or more, no tax would apply; 13½ to 14½ cents, a tax of ½ cent per pound would be imposed; 12½ to 13½ cents, 1¼ cents; and 12½ cents or less, 2 cents. These taxes would be somewhat less on lead-bearing ores, flue dust and mattes, and on zinc-bearing ores and concentrates.

The domestic lead-zinc mining industries, represented by Charles E. Schwab, chairman of the Emergency Lead-Zinc Committee, came out strongly for imposition of sliding scale excise taxes on imports. Schwab told the Committee that Congressional action is necessary if a sound lead-zinc mining industry is to be maintained in the United States.

He made it clear that the proposed tax schedules contained in the Administration measure fall far short of assuring a domestic "peril point" price for lead and zinc at which these industries can regain their strength. He recommended import taxes on lead ranging from 3 cents per pound when the price falls below 17 cents, to 5 cents when the price is below 15 cents; import taxes on zinc would be the same except they would apply when the price drops below 14½ cents and would reach the maximum of 5 cents per pound when the price is below 12½ cents. As to imported ore or concentrates, he recommended that the import levy be 70 percent of the suggested rates on lead and zinc metal.

An array of Senators and Congressmen from mining areas also urged the Committee to approve sliding scale import taxes to protect domestic lead-zinc mines and plants. Other industry spokesmen who made a strong case for the recommended legislation included Thomas Kiser, vice-president, Tri-State Zinc and Lead Ore Producers Association, and Miles P. Romney, manager, Utah Mining Association. In addition, a number of statements were filed with the committee by domestic producers supporting the position of the Lead-Zinc Committee. Mine labor also endorsed the program. Albert Pezzati, secretary-treasurer of the IMMSW union, called not only for imposition of import taxes on lead and zinc but for establishment of a quota system whereby total imports would be geared to the estimated total consumption needs of the economy, with individual quotas for each exporting country.

Opposition to the import taxes was expressed by R. F. Goodwin, president, Peruvian-American Association; James H. Stebbins, executive vice president, W. R. Grace & Co.; and Jean Vuillequez, vice-president, American Metal Co. Goodwin and Stebbins both declared that enactment of such legislation would be a blow to United States relations with Latin America. Vuillequez contended that the argument that domestic producers cannot compete with the low wage rates of other producing countries is "based more on emotions than on facts." He recommended that subsidies be given mines in the United States which justify Government assistance.

The Senate Committee will not be able to take any action on the bill until the House has approved a measure on the subject. Under the Constitution all tax and tariff proposals must originate in the House. The Ways and Means Committee will hold hearings on the proposals on August 1 and 2.

### TAX CUT OUTLOOK STILL BLEAK

President Eisenhower has again stated his opposition to any general income tax reduction at this time.

*(Continued on next page)*

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### Washington Highlights

**IMPORT TAXES:** Lead-zinc hearings held.

**TAX CUT:** Outlook bleak.

**GAS BILL:** Sent to House floor.

**TAFT-HARTLEY:** Revisions studied by Administration.

**INTERIOR DEPARTMENT:** Funds voted.

**LEASING ACT REVISIONS:** Approved by Senate.

**COAL RESEARCH:** House Committee report due.

**NUCLEAR REACTORS:** Government construction voted.

**ASSESSMENT WORK:** Bible bill reported.

**OIL IMPORTS:** Still under voluntary control.

**LAND WITHDRAWALS:** Military holdings curbed.

★ ★ ★ ★ ★ ★ ★

In a letter to Chairman Jere Cooper (Dem., Tenn.) of the tax-writing House Ways and Means Committee, he opposed a proposal to help small business by reducing taxes on the first $25,000 of a corporation's income from 30 percent to 20 percent. The loss of revenue would be too great, he said. But, the President added, "I earnestly look forward to reductions in tax rates for all taxpayers as soon as that becomes possible."

His views partially echoed the recent findings of the Fiscal Policy Subcommittee of the Joint Congressional Economic Committee. This Subcommittee, after hearing testimony from numerous financial experts in both Government and industry, concluded that, "In order to justify tax reduction under conditions of steady economic growth, more remains to be done by the Congress and the Administration with respect to actual Federal spending in fiscal 1958 than has been accomplished to date."

The Subcommittee report also asserted that, "The long-run growth conditions of our dynamic economy call for constant attention to revision of the Federal revenue structure. Structural changes which broaden the tax base and improve the fairness of our tax laws would permit substantial reductions in tax rates while maintaining necessary revenues . . . The timing of such revisions must give due consideration to the Government's revenue requirements and to economic conditions."

Another conclusion of the Fiscal Policy Subcommittee was that "inflation is a grave economic problem facing the American economy today" and that "failure to deal with it forthrightly will result in increasing hardships for millions of Americans." Restraining inflation is not an easy job, the report said, and "it requires making hard decisions in public policies."

## COMMITTEE APPROVES GAS BILL

After months of intermittent public hearings and closed-door sessions, the House Interstate Commerce Committee has approved, by the narrow margin of 15-13, a bill to slacken Federal Power Commission regulation of prices charged by natural-gas producers. The measure, a modified version of the natural-gas legislation vetoed last year by the President because of improper lobbying activities, would authorize the FPC to regulate producers' gas prices on a commodity basis instead of the current public-utility basis. Under a commodity basis, the reasonableness of the price would be a major consideration, whereas under a utility basis, cost of production would be the criterion.

The House is expected to vote on the bill this year. However, if it should win House approval, it is believed that the Senate Interstate Commerce Committee will not consider the legislation until next year.

Prior to acting on the natural-gas bill, the House Committee turned down two amendments offered by Rep. Staggers (Dem., W. Va.). Strongly supported by the coal-mining industry, these amendments would have (1) authorized the FPC to exercise control over direct sales of natural gas and (2) prohibited below-cost sales of natural gas to industrial consumers. As a result, the coal-mining industry generally is opposed to the bill's enactment.

## TAFT-HARTLEY OVERHAUL STUDIED

The Eisenhower Administration believes there is need for a complete review of all legislation having to do with labor and management relations, but apparently does not plan to have concrete suggestions ready for submission to Congress until the end of 1958.

In disclosing these views, Labor Secretary Mitchell made it plain that the Administration has no plans to junk the Taft-Hartley Act. "We believe that basically this Act is a sound piece of legislation," Mitchell said, "but like all legislation dealing with human relations, it needs revision after 10 years of experience." He did not say what features of the law the Administration believes should be overhauled nor how sweeping its proposals would be.

Labor leaders, who in the past often termed the Taft-Hartley Act a "slave-labor law" and demanded that it be repealed, have been relatively quiet of late. Observers believe their silence results from the special Senate "rackets" committee's revelation of misuse of union funds and other abuses of power within high union circles, and the resultant unfavorable public and Congressional reaction.

## INTERIOR DEPARTMENT FUNDS VOTED

Congress has appropriated $456.2 million for operation of the Interior Department and related agencies, including the Forest Service, for the fiscal year 1958, which began July 1. Although the total is 59 million less than the amount requested in the President's budget, many of the Department's subdivisions with responsibilities in the minerals field received substantial increases.

The Bureau of Land Management was allocated $27,480,000 for the current fiscal year, a 20 percent boost from its 1957 total of $22,969,300. The Geological Survey received $36,000,000 (up 14 percent); the Bureau of Mines, $25,853,000 (up 14 percent); and the Forest Service, $119,216,000 (up 12 percent). The Office of Minerals Mobilization was cut to $263,000 from its 1957 total of $300,000.

Bulk of the Department's budget cut resulted when Congress appropriated only $6.7 million of a request for $40 million to continue Government purchases of domestic tungsten, asbestos, fluorspar, and columbium-tantalum. The sum approved was earmarked for acquisition of asbestos and fluorspar, thus giving the *coup de grace* to continue Government buying of domestic tungsten, a program initiated during the Korean War.

The Senate had attempted, on three earlier occasions this year, to amend House-passed supplemental appropriation bills to provide funds for domestic mineral purchases. Each time the House was obdurate in its refusal to concur, on the basis that most of the proposed funds would be expended for tungsten and that Government tungsten holdings are ample for any emergency. The Senate did not try to include funds for tungsten in the regular 1958 Interior money bill.

As a result, many of the Nation's tungsten mines are shutting down. They are unable to compete with foreign producers at current market prices, which are considerably lower than prices at which Government purchases were made.

## SENATE ACTS ON LEASING BILL

Moving with unusual celerity, the Senate has approved and sent to the House a recently introduced bill to increase the amount of Federal public lands a coal lessee may hold within the borders of any one State. Sponsored by Wyoming Senators O'Mahoney (Dem.) and Barrett (Rep.), the measure is aimed at expediting development of vast public-domain coal reserves in Wyoming and other Western States.

The bill would boost the present maximum of 5,120 acres which may be held by a coal lessee within a State to 10,240 acres, and give the Secretary of Interior authority to lease up to an additional 5,120 acres if he determines that the lessee needs more land to economically conduct coal mining.

Enactment of the measure has been recommended by the Department of Interior, and House sponsors of companion bills—Reps. Thomson (Rep.,-Wyo.), Edmondson (Dem., Okla.), Albert (Dem., Okla.), and Patman (Dem., Tex.)—are hopeful that House action will soon be forthcoming.

Also awaiting House action is an earlier Senate-passed measure to eliminate the 5,120-acre limitation on public lands which may be held by a phosphate lessee within any one State. The House Interior Committee has approved this bill, which

*(Continued on page 104)*

# AMC Personals

The appointment of **John Cameron Fox** as secretary of the Society of Mining Engineers of AIME has been announced. Fox, one time editor of MINING CONGRESS JOURNAL, succeeds **Arnold Buzzalini,** who has resigned to enter the field of consulting geology.

Pacific Coast Borax Co. Division of United States Borax & Chemical Corp. has announced the appointment of **Jay B. Ford, Jr.,** as assistant general manager of this division. Ford was formerly with the United States Potash Co. Division, where he had been assistant treasurer and subsequently assistant general manager.

The appointment of **Dr. Earl F. Cook** as dean of the University of Idaho, College of Mines and director of the Idaho Bureau of Mines and Geology was announced recently.

Cook has been serving in an acting capacity in both positions for the past year, since the resignation of **Dean J. D. Forrester.**

**Earl L. Bilheimer** has been appointed resident manager of the Meramec Mining Co. which was recently organized under joint ownership of St. Joseph Lead Co. and Bethlehem Steel Co. to develop and mine a huge deposit of magnetite and hematite near Sullivan, Mo.

Bilheimer has been with the St. Joseph Lead Co. at Bonne Terre, Mo., since 1922, having served mostly in operating supervisory capacities but more recently as manager of the Employees' Relations Department.

**Jerry E. Tong** has been promoted to the position of resident manager of Duval Sulphur & Potash Company's Potash Division, succeeding **George Atwood,** who has been transferred to the newly-established Copper Division of the company as resident manager of the Esperanza property near Tucson, Ariz.

Four top supervisory employes are being transferred from Carlsbad to Tucson with Atwood. **H. A. London,** superintendent of maintenance and construction in the Potash Division, holds the same position in the Copper Division; **I. B. Phillips,** mill superintendent in the Potash Division, will be mill superintendent in the Copper Division; **S. C. Polasek,** chief accountant, will handle the same duties in the Copper Division, and **B. G. Messer,** former chief engineer of the Potash Division and who has been in charge of copper exploration work for the company near Tucson, will be assistant resident manager.

Promotions in the Potash Division include the naming of **J. W. Borskey** as assistant resident manager; **D. J. Bourne,** refinery superintendent; **A. T. Jones,** superintendent of maintenance and construction; **M. H. Harrison,** refinery general foreman; **Theodore H. Pate, Jr.,** chief accountant; **B. F. McGuire,** chief engineer; **W. M. Bourn,** refinery assistant general foreman; **W. H. Long,** maintenance and construction general foreman, and **C. R. Tagert,** assistant surface mechanical foreman.

## JOIN AMC STAFF

Two new men—**Brice O'Brien** and **Laurence P. Sherfy**—have joined the staff of the American Mining Congress and will devote a major part of their time to the tax problems of the industry.

**Brice O'Brien**

A native of South Dakota, Brice O'Brien graduated from the Law School of Columbus University in 1941. He was admitted to the Bar of the District of Columbia in 1941 and of the United States Supreme Court in 1948. Early in 1942 he joined the Army Air Force and flew 13 missions in the European Theatre of Operations. He was a prisoner of war for a year.

After his discharge in 1945, O'Brien joined the staff of the National Coal Association where he gained broad experience in organization work. As assistant counsel and tax counsel for NCA, he was responsible for industry presentations before congressional committees, the Internal Revenue Service and other Government agencies. O'Brien is co-author of several chapters in the forthcoming edition of *Merten's "Law of Federal Income Taxation,"* a standard reference work in the tax field.

Laurence P. Sherfy, a native of Washington, D. C., comes to the Mining Congress from the Internal Revenue Service. He is a graduate of George Washington University and holds a Master of Laws Degree from Harvard Law School. During World War II he served with the Navy, attaining the rank of Lieutenant Commander.

Sherfy's law experience dates back prior to the War when he was law editor for *United States News,* Bureau of National Affairs, and special attorney for the Anti-Trust Division of the Department of Justice. After his release from the Navy, he returned to the Department of Justice. From 1950 to 1952 he acted as special counsel to the Preparedness Investigation Subcommittee of the Senate Armed Services Committee. Since October, 1952, he has served with the Internal Revenue Service in various capacities, ranging from special assistant to the Chief Counsel to supervising legislative attorney in the Legislation and Regulations Division.

**Laurence P. Sherfy**

The broad experience of both these men will be brought to bear in the many important tax problems that lie ahead for the mining industry.

**William I. Powell,** secretary of the A.M.C. Tax Committee for the past seven years, has accepted a similar position with the Independent Petroleum Association.

"Bill" takes with him the good wishes of his many friends in the mining industry.

Two promotions have been announced in the engineering department of Utah Copper Division, Kennecott Copper Corp. **Milton O. Gold**, formerly electrical design engineer for the western mining division, was promoted to project engineer of the Utah division. **Clyde Beck**, former assistant engineer at the refinery, was named refinery engineer.

**R. Lee Aston** has resigned as mine geologist for the Tennessee Copper Company's operation at Ducktown, Tenn., to become the plant engineer of the Signal Mountain Division of the General Portland Cement Company's operation at Signal Mountain, Tenn.

Reserve Mining Co. has announced that **E. K. Smith** is now purchasing agent of the company.

**Dr. Hubert Risser**, assistant professor in the Department of Mining and Metallurgical Engineering at the University of Kansas, has accepted the position of mineral economist in the Mineral Economics Section at the Illinois State Geological Survey.

**William S. Van de Mark** and **Paul W. Allen** have been elected vice-presidents of Cyprus Mines Corp.

**Ezra J. Kennedy, Jr.**, assistant secretary of the American Institute of Mining, Metallurgical, and Petroleum Engineers, has retired. Kennedy has spent the last 31 years on the headquarters staff of AIME.

**Raymond C. Dosta**, former assistant treasurer of the United States Borax & Chemical Corp., has been promoted to treasurer, succeeding **R. F. Steel**. Steel earlier was named to the newly-created post of assistant general manager.

**Robert L. Crammer**, formerly with New Park Mining Co., is now associated with Royal Corp., Palo Alto, Calif., as general manager of mining operations.

**Dennis J. Keenan** has been promoted to vice-president in charge of operations of Sterling Coal Co. He had been general superintendent of Sterling mines 1, 6 and 9.

**Richard B. Davern** has been named to succeed **Raymond L. Larson** as treasurer of the United States Steel Corp.'s Oliver Iron Mining Division. Larson retired recently after 45 years of service with Oliver.

**Virgil Cook** has been named safety director of the Lillybrook and Amigo Smokeless Coal Companies with main offices at Affinity, W. Va. Cook had been a State mine inspector for 17 years before moving to his new position.

**Joe S. McClellan** has been appointed superintendent of the Bishop mine of the Pocahontas Fuel Co. He succeeds **Charles T. Stephenson** who is being assigned to special duties with the office of the general superintendent.

McClellan entered employment of the Fuel Company in 1951 after 17 years of employment with coal producing companies in eastern Kentucky. He has been employed at the company's Itmann operation since 1951 as section foreman, assistant night foreman, general mine foreman and assistant superintendent.

Stephenson has been employed by the Fuel Company since 1938 as section foreman, general mine foreman, and superintendent. Prior to coming to Pocahontas Fuel he worked for the Yukon Pocahontas Coal Co. for 12 years and one year with Pond Creek Coal Co.

## — *Obituaries* —

**L. Russell Kelce**, 59, president of the Peabody Coal Co., the nation's second largest commercial producer of bituminous coal, died July 1.

The fourth generation of a coal mining family, Mr. Kelce went into the Kansas coal mines as a boy of 12. At the age of 19 he was the youngest mine superintendent in the Kansas coal fields. Following service with the Army in World War I, Mr. Kelce managed a strip mine near Dawson, Okla., and a short time later joined the Sinclair Coal Co. He became president of Sinclair in 1949 and in 1955 affiliated the properties of that company with those of Peabody Coal Co. to form a company that now produces in the neighborhood of 22,000,000 tons annually.

Active in business generally, Mr. Kelce at the time of his death was chairman of the Board of the Chicago Great Western Railway, and a member of the board of the Kansas City Southern Railway.

**H. Conrad Meyer**, retired chairman of the board of the Foote Mineral Co., died June 10. Mr. Meyer had been associated with Foote Mineral for 50 years before his retirement in 1955. He became the company's vice-president in 1916 and president in 1936.

**Frank Cartlidge**, 82, design engineer, Goodman Manufacturing Co. for 28 years, died May 28.

Mr. Cartlidge's entire career, starting at the age of 13, had been devoted to the mining industry. Following a variety of mine jobs including that of master mechanic, he was associated with the Frank Prox Co., the Sullivan Machinery Co., where he helped develop the first successful shortwall and track mounted cutting machines, and the Cincinnati Mine Machinery Co., which he organized in the early 1920's. He went to Goodman in 1929 where he specialized in loader and continuous mining machine design.

**George F. Zoffman**, president and chairman of the board of the Duval Sulphur & Potash Co., died June 5.

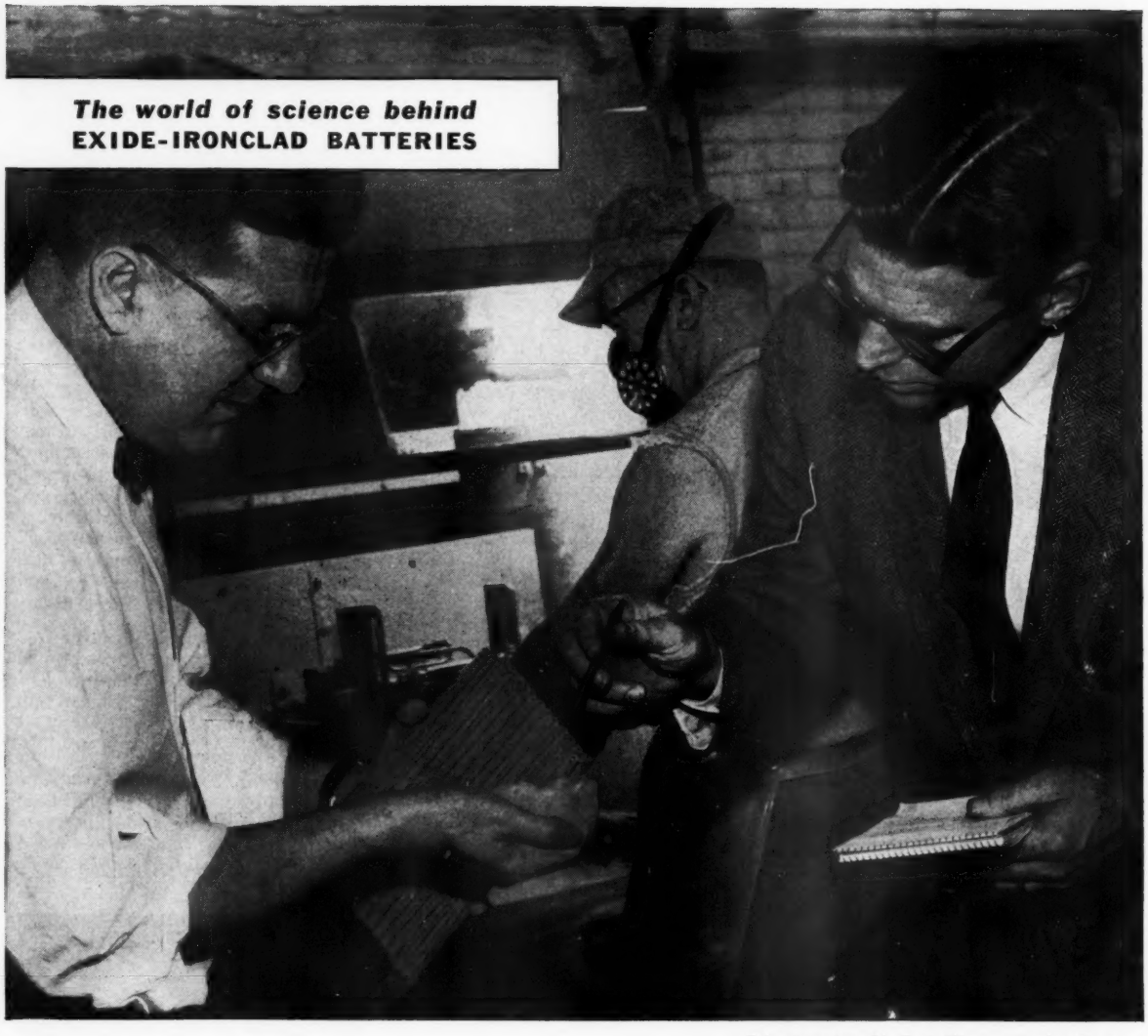
Mr. Zoffman was elected chairman last March. He had been president since 1930.

**John Edward Jones**, 73, retired mine safety engineer for Old Ben Coal Corp., died suddenly at his home in Benton, Ill., on June 30. Known throughout the coal industry as "Rock Dust Johnny," Mr. Jones was a pioneer in the development of rock dusting techniques to minimize the threat and localize the effect of dust explosions in underground coal mines.

Mr. Jones was born in North Wales, coming to the United States when he was eight. From 1912 to 1915 he was division engineer for the J. K. Deering Coal Co. over mines in Illinois and Indiana. Following two years as an Illinois State mine inspector, Mr. Jones joined Old Ben Coal Corp. as safety engineer in 1917. He remained with Old Ben until his retirement in 1953.

A nationally recognized authority on coal mining safety, Mr. Jones served as mine safety consultant to the secretary of the Department of the Interior in 1943. In 1946 he served as coal mines administrator, safety engineer and consultant in Washington, D. C., and co-authored the Federal Mine Safety Code.

***The world of science behind***
**EXIDE-IRONCLAD BATTERIES**



*Being interviewed is E. A. Wagner, Product Engineer*

## *"This oxide blend packs more power per ounce"*

*At the Exide Laboratories*—**Reporter:** More power, Mr. Wagner? Do you mean the blend of oxides in Exide-Ironclad is different from that used in other batteries?

**Wagner:** Absolutely. We can use the more active oxides that give the batteries higher capacity.

**Reporter:** Why do you say *can?* Can't other batteries use these oxides too?

**Wagner:** It isn't likely. First, this blend is the result of more than 40 years of Exide research—and it's an Exide exclusive. Second, we can use it successfully because of the unique tubular construction of the Exide-Ironclad positive plate.

**Reporter:** How does tubular construction help make it a better battery?

**Wagner:** Because the cylindrical power tubes hold the tiny oxide particles firmly in electrical contact clear through the charge and discharge cycle. So Exide-Ironclad Batteries can maintain their high capacity—even under severe vibration—for years of service.

**Reporter:** Obviously, this is an important feature of Exide-Ironclad Batteries.

**Wagner:** Yes it is, but it's just one of many engineering details that contribute to its high capacity and long life.

**Note to battery users.** Whenever you order heavy duty batteries or the equipment that requires them, be sure to specify Exide-Ironclad. For bulletin, write Exide Industrial Division, The Electric Storage Battery Co., Phila. 2, Pa.

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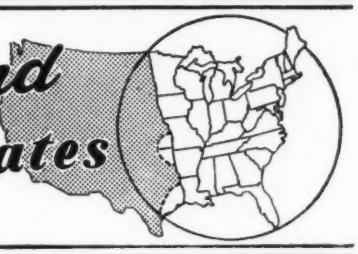
# NEWS and VIEWS

## Eastern and Central states



### Oliver Taps Large Reserve of Direct Shipping Ore

On July 5 the first carload of iron ore was brought out from the newly reactivated Stephens mine, three miles northeast of Aurora, Minn. The mine for years has been the largest inactive reserve of direct shipping ore owned by the Oliver Iron Mining Division of U. S. Steel Corp.

The Stephens mine was originally explored and acquired by Henry and Albert L. Stephens of Detroit, Mich., during the early 1890's. The land was leased to the then Oliver Iron Mining Co. on a 50-year agreement in 1899, and about 500,000 tons of ore were shipped from 1903 to 1905. Operations were suspended when the owner decided to sell the property, and in 1912 the mine was purchased by Oliver.

Oliver has been able to conserve this direct shipping ore all these years because of success in the beneficiation of lower grade wash ores.

In June 1956 the work of clearing brush and stripping at the Stephens Mine was begun. To prepare the mine for production, it was necessary to divert a stream, and to install extensive mine facilities. In addition to a truck pocket and a crushing and screening plant, installations were made to provide shipping pockets, conveying equipment, maintenance facilities, a power distribution system, and a water supply and sewage system. Present scheduling calls for 2,600,000 tons of ore to be mined this year and 3,500,000 tons next year. There is an estimated 47,000,000 tons of direct shipping ore on the property.

### Truax-Traer Trains Foremen

The Traux-Traer Coal Co. has established an on-the-job training program for miners to prepare them for foremen's positions and other supervisory positions. The course consists of a three-month session of classes and actual mine work.

To complete the course a miner devotes 600 hours to actual work in the mine and a minimum of 75 hours to discussion and textbook study. For the mine work, the trainees spent two-week periods at six of Truax-Traer's nine mines in the Charleston, W. Va., area. After spending an eight-hour day in the mine the trainee then spends one hour or more in the classroom for lectures and discussions.

### Uranium Found in Florida

A uranium strike of undetermined value has been made near Oviedo, Fla., by a watercress farmer who was sinking artesian wells. Samples have been sent to Government testing laboratories to determine the actual uranium content.

Geiger counters indicated radioactivity on about 33 acres of the farm. It was reported that the ore was 61 ft underground.

### Bethlehem Prepares Mine

The Grace Mine, which is being developed by the Bethlehem Steel Co. at a cost of between $35,000,000 and $40,000,000, is expected to be in full production about 1960 providing about 12,000 tons of iron ore per day. The mine is located near Morgantown, Pa., and initial work was started in 1951.

Company officials estimate that the mine will provide iron ore for at least 50 years for the blast furnaces in Bethlehem and Steelton, Pa. The ore contains about 42.5 percent iron.

The company is experimenting with TV cameras to watch as the ore is loaded into hoppers for the ascent from the mine. The monitor for observation is located on the surface.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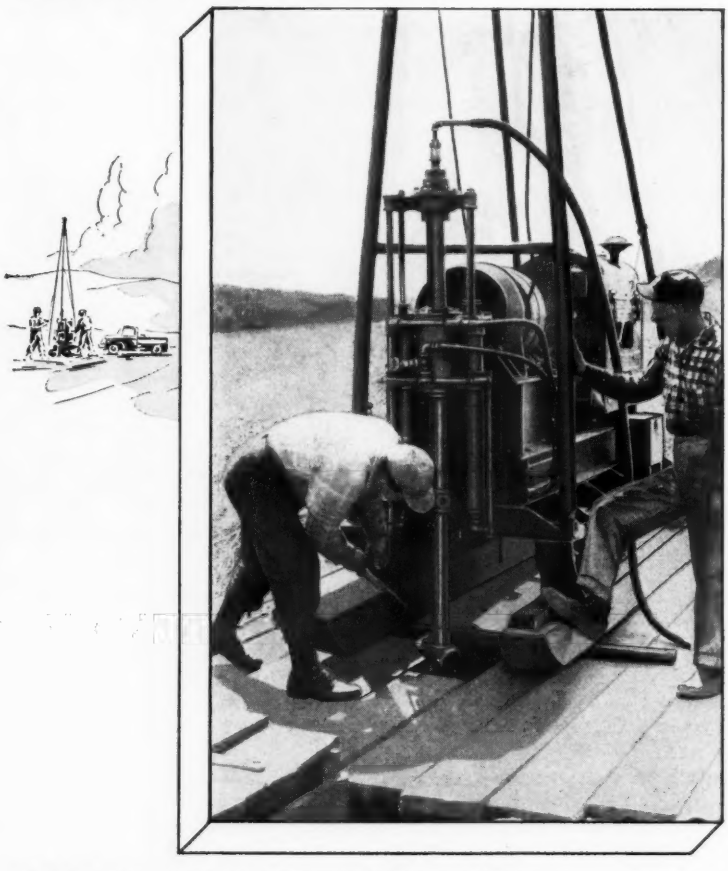

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## Lake Superior Iron Ore Association Changes Name

At its 63rd Annual Meeting, held June 11, the membership of the Lake Superior Iron Ore Association voted to change the organization's name to the American Iron Ore Association.

The new name recognizes the geographical shifts in the sources of iron ore which have been taking place over the last ten years. For many years Lake Superior mines supplied the bulk of the ore used in the United States. Today, however, the industry is spread out over the United States and Canada.

Association statistics have been revised to include ore movements from these new sources, and now cover all ore produced and consumed within the boundaries of the United States and Canada.

The following companies were announced as new members of the Association: Ford Motor Co., Steep Rock Iron Mines, Ltd., Oliver Iron Mining Division, United States Steel Corp., Reserve Mining Co., and Iron Ore Co. of Canada.

## West Virginia Mines Active

With only one mine among the ten top producing mines in the country, West Virginia supplied 30 percent of the nation's soft coal requirements in 1956. The Pocahontas Fuel Company's Itmann Mine at Itmann was fourth in the nation in coal production with 2,832,540 tons. The West Virginia total was 151,000,000 tons.

The leading mine in the nation was Peabody's No. 10 at Pawnee, Ill., which produced 3,427,396 tons from an 84-in. seam. The Mathies Mine of the Mathies Coal Co. of Finleyville, Pa., was the second largest bituminous coal producing mine in 1956 with a production of 3,012,667 tons.

## Cerro de Pasco Expands

Announcement was made recently that the Cerro de Pasco Corp., will purchase the Lewin-Mathes Co. of St. Louis through a stock transfer. Lewin-Mathes, founded in 1931, operates the only copper refinery in the mid-west at Monsanto, Ill.

The Lewin-Mathes Co. is a completely integrated manufacturer of copper and brass tube, pipe and rod. Its production ranges from secondary smelting through finished products.

Robert P. Koenig, president of Cerro de Pasco, said that the agreement entered into provides for acquisition of Lewin-Mathes properties and assets and assumption of outstanding liabilities and issuance of the Cerro de Pasco common stock. He said that the acquisition by Cerro de Pasco represents "a step of major importance in advancing the corporation's long-range objective of diversification.

### Algoma Tries Electronics

An extensive system of electronic controls has been purchased by Algoma Steel Corp. for use in the first card-programmed automatic steel mill to be built in Canada near Hamilton. The card programming is to be adapted initially for automatic thickness control and engineered for a wider application in the future.

The new system will enable one mill operator to initiate a complete steel-rolling schedule by pressing a single button on a control panel. The entire operation, for one or several passes through the mill, is predetermined by holes punched in IBM cards. The control unit is called Prodac-programmed digital automatic control.

The company is also installing closed circuit industrial television for constant surveillance of critical mechanical operations. Cameras will be located at strategic points and hooked up to a central monitor.

### Clinchfield Plans Plant

Announcement was made recently of plans of the Clinchfield Coal Co. to construct a new preparation plant at the company's Moss No. 3 mine near Dante, Va. Clinchfield is a division of the Pittston Co.

Bristol Steel & Iron Works was awarded a contract for more than $1,000,000 of structural steel for the new plant which is to supply the bulk of the coal to feed Appalachian Electric Power Company's new Clinch River generating plant. The plant will use 1,300,000 tons of coal annually—enough to fill a string of railroad cars 246 miles long. Clinchfield has set aside 40,000,000 tons of coal from reserves to supply the power company's 20-year requirements.

### Zinc Smelter Operations Close

The American Steel & Wire's zinc smelting plant at Donora, Pa., will be closed about November 1, according to officials of the company. The plant has been in operation for 42 years and company officials said that the plant was being closed because it was no longer an economical operation.

The plant was built in 1915 to insure a steady supply of zinc to the U. S. Steel Corp., the parent concern. Company officials have said that efforts will be made to place 450 men who will be out of work in other operations of the steel company. There are about 550 men employed at the Donora plant, but about 100 will remain to operate the sulfuric acid plant.

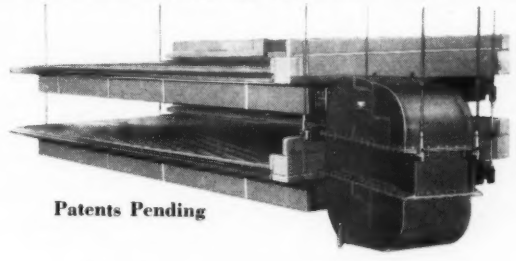
"During World War II and the period immediately following, the emphasis was on production of zinc to fulfill the requirements of the U. S. Steel Corp. and cost was of secondary importance. However, in recent years, serious ore shortages have developed and our production costs for Donora zinc have continued to rise, while the price of the metal on the open market has reflected its ready availability," according to a company spokesman.

### Urges Larger Coal Fleet

Speaking at the 12th annual luncheon of the Coal Exporters Association of the United States, Inc., Clarence G. Morse, chairman of the Federal Maritime Administration, urged American coal producers to act quickly to expand the present small export volume of American coal being shipped in American flag vessels.

Morse said that by developing a new "modernized system of ocean transport for coal, in the long run you can more nearly secure your markets, lower your costs and maintain reasonable profits."

The Administrator called American Coal Shipping, Inc., a move in the right direction.

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## WHEELS OF GOVERNMENT

*(Continued from page 97)*

would not disturb the present over-all United States ceiling of 10,240 acres of such holdings by one lessee.

### COAL RESEARCH REPORT DUE

The special House Interior Subcommittee on Coal Research, set up last year to study the need for intensified activities in coal research, is winding up its report and recommendations for submission to Chairman Engle (Dem., Calif.) of the full Interior Committee. Its findings will be based upon information gathered at a series of public hearings in Washington and in representative coal-mining areas of the country.

While the Subcommittee will recommend that the Federal Government step up its coal-research activities, it is reported that there is dissension among Subcommittee members with respect to desirable fields of research and the emphasis which should be placed on various aspects of an over-all research program.

There is a good possibility that the report will be critical of current Bureau of Mines activities in this field, on the basis that its work emphasizes long-range studies, such as synthesis of liquid fuels, and not development of additional uses of coal for the immediate future.

Coal-mining men are eagerly awaiting the Subcommittee's report and the promise it holds for greater and more diversified use of the Nation's enormous solid-fuel resources.

### REACTOR PROGRAM APPROVED

Proponents of Federal construction and supervision of nuclear reactors for power production scored a victory late in July when a Joint Atomic Energy Subcommittee approved a bill directing the Atomic Energy Commission to enter into contracts with machinery manufacturers for construction of seven reactors, to be located in Alaska, Idaho, Michigan, Minnesota, Nebraska, Ohio and Washington. These reactors would require an outlay of over $100 million. The AEC had originally planned that five of them would be constructed and operated by utility cooperatives and other public power groups.

Under terms of the measure, the Government could operate the reactors itself or enter into contracts with public power groups for their operation under Government supervision. The bill would also authorize funds for research and development of reactor projects, but would reduce U. S. financial aid to private utility groups now building reactors.

### ASSESSMENT WORK BILL REPORTED

Since 1872 the general mining laws have required that "not less than $100 worth of labor shall be performed or improvements made during each year" on each claim until a patent has been issued therefor. Court decisions through the years have interpreted what the 42nd Congress meant by "labor" or improvements," but a number of mining State legislators have taken the position that a change in the basic law is necessary to afford recognition of modern mineral exploration techniques.

In line with this thinking, the Senate Interior Committee has amended and approved a bill by Senator Bible (Dem., Nev.) to provide that the term "labor" shall "include, but not be limited to, geological, geochemical, or geophysical surveys made by credited technicians employing generally recognized equipment and methods, or other recognized means of determining the existence, extent of concentration, or accessibility of minerals on the claim."

Mining industry observers expect the Senate to pass the bill. The House Interior Committee will then consider the measure.

It is interesting to note that the Department of Interior has held that, under present law, "invisible" assessment work cannot be credited toward the patent requirement of $500 worth of labor or improvements per claim. The question remains whether enactment of the Bible bill would change the Department's views in this respect. The Department did endorse the Bible measure as to crediting geological, geophysical and geochemical surveys towards performance of the annual labor requirements, but gave no indication as to whether such work could be credited towards patent requirements. Presumably, if the measure becomes law, the Interior Department would issue regulations not only defining what geological, geochemical or geophysical work can be credited towards the performance of assessment work, but also setting up safeguards against possible abuse of the new provisions.

### OIL IMPORT CURBS STILL "VOLUNTARY"

As this is written, a special Cabinet Committee, appointed by the President to study oil imports, is about to recommend another "voluntary" reduction in crude oil imports to hold such imports to fifteen per cent of domestic production, as compared with the ten per cent ratio recommended in 1955 by the President's Fuels Advisory Committee.

Meanwhile, ODM Director Gordon Gray has told the coal industry that he has no reason to believe that the level of residual oil imports is such as to threaten impairment of national security. The industry had requested the ODM to study the residual oil import situation and to make a finding that such imports were a threat to national security. Gray said that while residual oil imports may be higher than previously "I cannot find, as required by my obligation, that their impact upon the coal industry is such as to provide a basis for certification under Section 7 (of the Trade Agreements Act)." Under this provision, if ODM certifies that imports of a commodity threaten national security, the President may take steps to curb such imports.

With the Administration failing to bring about mandatory curbs on residual oil imports, it is likely that increased efforts will be made on Capitol Hill at the next session to stem the flow of foreign residual oil which has proven so harmful to domestic coal producers, railroads and mine labor.

### MILITARY LAND WITHDRAWALS CURBED

A sharp reduction in withdrawals of public domain lands by the armed forces appears in the offing. The House has already passed a bill making necessary that the military obtain Congressional approval of all proposed land withdrawals of 5,000 acres or over, and a Senate Interior subcommittee has now reported this measure to the full Committee. Early approval by the full Committee and by the Senate are forecast.

This measure has been strongly supported by the American Mining Congress and other mining organizations. Its enactment would prevent the military from withholding large blocks or land from mineral locations as in the past. During hearings on the House measure it was pointed out that many lands withdrawn by the armed services had been left idle and that the various services had not made any coordinated efforts to utilize lands presently withdrawn.

Now before the House Interior Committee is a Senate-passed bill which would establish a National Outdoor Recreation Resources Review Commission, to study recreation resources of the public land and water areas of the United States. The Commission, which would have until the end of 1959 to complete its study, would be required to determine not only the resources available but the utilization to be made of them. Indications are that the measure will be adopted by the Congress at an early date.

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## Approves Anthracite Drainage Project

A drainage project to protect one of the largest anthracite mines in the Shamokin, Pa., area against flooding has been approved by the Department of the Interior.

The most extensive surface operation yet authorized under a $17,000,000 State-Federal mine-drainage program, the work is expected to cost nearly $250,000. It will involve enlarging existing earth ditches, excavating several thousand feet of new earth ditches, installing more than 6500 ft of concrete flume and pipe, and filling in several old stripping pits and crop falls.

Site of the project is the Glen Burn No. 14 Slope Mine, about two miles west of Shamokin. Operated by the Susquehanna Collieries Division of the M. A. Hanna Co., this mine is a relatively new operation, employing about 200 men and producing approximately 330 mine cars of coal a day. The company expects the mine ultimately to produce 500 cars of coal daily and to employ more than 300 men. The No. 14 Slope is one of the main sources of production for the Glen Burn breaker, which employs nearly 1000 men.

## Titanium Plant Site Chosen

A multi-million dollar plant to produce titanium forgings and billets will be constructed by Allied Kennecott Titanium Corp. near Wilmington, N. C., it was announced recently by officials of the newly organized company. Joint owners of the new corporation are Allied Chemical & Dye Corp., and Kennecott Copper Corp.

The new plant, which has a frontage of about two miles on the Cape Fear River, will employ about 500 persons. Located on a 1500-acre tract, the new facilities will include a research and development laboratory in addition to the plant itself.

## Brazilian Manganese Developed

Annual exports of 600,000 to 700,000 tons of manganese ore are expected from Brazilian mines which have started operations, according to company officials. The mines are located in the Amapa territory of northern Brazil and were developed by a company formed by a Brazilian firm and a United States steel concern.

To reach the anticipated exports, Brazilian exports would have to treble, making Brazil one of the largest manganese exporters in the world. It is expected that the 600,000 to 700,000 tons of ore would be valued at $35,000,000.

It is believed that reserves amount to 30,000,000 tons with a metal content of 46 percent.

## New Feldspar Plant Begun

The Lawson-United Feldspar & Mineral Co. recently started operations at a new feldspar plant at Spruce Pine, N. C.

The plant is reportedly equipped to refine 8000 tons of glass-grade feldspar, 2500 tons of low iron and glass melting sand and 400 tons of mica per 25-day month.

Company officials expressed the hope that a refining unit for producing pottery, sanitary ware, tile, enamel, cleanser and other ceramic-grade feldspar would be in operation by November 1.

## Cuban Copper Plant Opens

Cuba's first copper fabricating plant was opened recently by its joint owners, Phelps-Dodge Corp., Banco de Fomento Agricola e Industrial de Cuba and Holland Insulated Wire and Cable Works. The new plant is located near San Jose de Las Lajas, about 30 miles from Havana.

President of the new company, Productos de Cobre de Cuba PhelDrak, is Howard T. Brinton, currently head of Phelps-Dodge's fabricating subsidiary, Phelps-Dodge Copper Products Corp.


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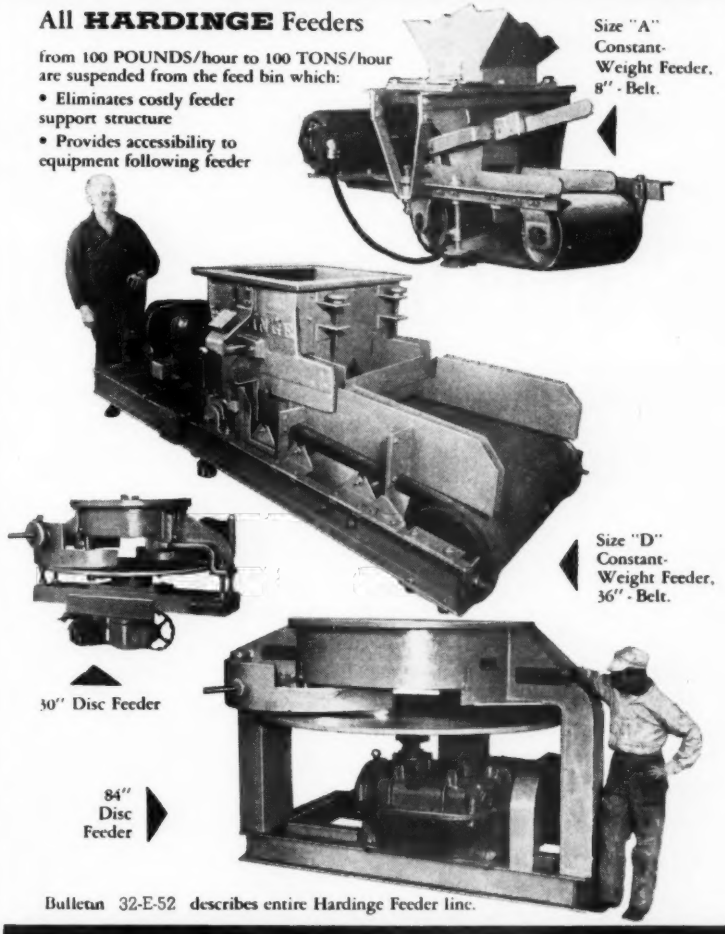


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### Coal Exports Up

Coal exports from the United States should reach unprecedented heights during 1957 if they continue at the same rate established during the first five months of the year, according to John S. Routh, president of the Coal Exporters Association of the United States, Inc.

Routh said that shipments from the United States since the start of the year have been at a record-breaking rate of around 5,000,000 tons a month with a total of 25,851,127 tons of both bituminous and anthracite exported, exclusive of shipments to Canada. This is compared with 18,284,741 tons in the first five months of last year. The total coal tonnage exported in 1956 was more than 51,000,000 tons, making that year the best on record for coal exports. "If shipping rates are kept at a reasonable level, then coal will continue to move abroad in substantial volume," according to Routh.

### Japanese Visit Here

A team of 16 Japanese were in Cleveland recently to study how ore is moved on the Great Lakes. They represented both the government of Japan and private concerns which are ore users and bulk material transporters.

"They are primarily interested in learning how ore is moved with less manpower and with greater efficiency," said Bradford J. Johnson, project manager with the International Cooperation Administration. According to Johnson, Japanese industry is severely hampered by costly transportation shortages.

After the study period with officials of the American Ore Association, the group visited Republic Steel Corp. and the Wellman Engineering Corp. facilities.

### Sell Coal Interests

The New York Coal Co. of Columbus, Ohio, has been renamed Davon, Inc., as a result of action taken at a stockholders meeting held recently. The announcement was made by Edwin H. Davis, chairman of the board.

Davis said the change was made because the company had sold its coal mining interest in Ohio, Kentucky and West Virginia and is concentrating on other aspects of the business which include production of agricultural limestone, concrete aggregate, road stone, railroad ballast, rock dust for coal mines, and blast furnace flux together with ready-mix concrete.

### New Coal Book Published

The Department of the Interior recently announced the publication of a new book reviewing the coal needs and supplies in Western Europe. The book, entitled "Review of Coal Supplies and Requirements in Western European and Soviet Bloc Countries," can be obtained from the Bureau of Mines, Publications-Distribution Section, 4800 Forbes Street, Pittsburgh 13, Pa. It is identified by the number I.C. 7778.

The report is divided into four sections dealing with (1) present and future fuels and energy position in Europe; (2) summaries of energy requirements and capabilities of individual free European countries; (3) description of coal supply and requirements of Soviet bloc countries, and (4) a statistical summary.

The book concludes that European demand for coal from the United States will rise in 1957 and is likely to increase during the next 20 years.


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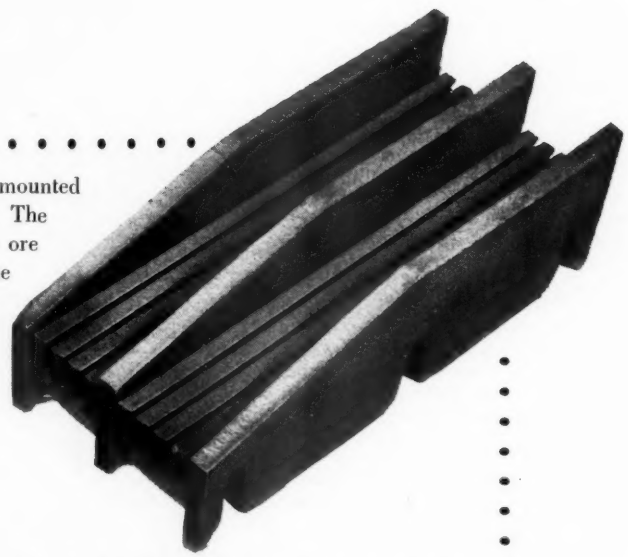

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Aerial view of
Mid-Continent Coal Mine
at Marissa, Illinois

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Vice-President Operations
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- Rolls coal forward for faster, easier loading
- Easier on "tender" roofs—cuts timbering, bolting
- Lowers cleaning costs by minimizing fines
- Reduces degradation—no shattered coal

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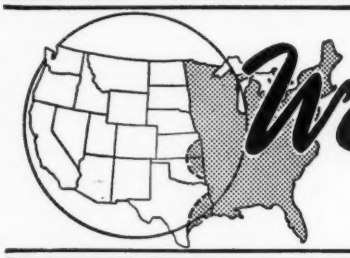

# Western States

## Hecla Accelerates Project

Hecla Mining Co. is driving three exploration headings on an around-the-clock schedule on the 2000 level of the Silver Mountain property east of Mullan, Idaho.

The north crosscut from the bottom of the new shaft has intersected its initial objective, the Paymaster fault, and development drifts are now being started both to the east and west along the fault structure. The drifts will be on the footwall side of the fault and will be extended roughly 3000 ft in each direction.

The Silver Mountain project is a joint Hecla-Bunker Hill Co. venture, with Hecla as the operating company. It is being carried out under an operating agreement with Silver Mountain Lead Mines Co.; total cost of the project is estimated at nearly $1,500,000.

The Silver Mountain workings will also provide deep-level access to the southeasterly adjoining property of Princeton Mining Co., which Hecla and Bunker Hill have also undertaken to explore and develop under a profit-sharing agreement.

## Iron Ore Land Leased

Columbia-Geneva Steel Division of U. S. Steel Corp. has leased iron ore properties in Fremont County, Wyo., owned by Ruby Co. of Boise, Idaho.

The lease embraces about 1200 acres of mining properties and extends for 75 years unless sooner terminated by Columbia-Geneva.

There still has been no decision that the division will proceed with the development of this iron ore reserve or with the building of the crushing and beneficiation facilities that would be required. The program is known as the "Atlantic City project" because of a ghost mining town of that name near the site.

If Columbia-Geneva decides to go ahead with development, an open-pit iron mine and multi-million dollar processing plant could be operating there within 2½ years.

The company spokesman said the development in the Lander area would be a long-term proposition. A firm figure on ore tonnage was not given but the spokesman said that "it would be a major contribution to the iron-ore supply for Geneva works for a good many years."

Pelletizing of the low-grade ores would be required. It has not been decided whether the pelletizing would be done at the beneficiation plant at the mine or at the Geneva Works near Provo, Utah.

## Boosts U-Ore Production

Giant Resources, Inc., has stepped up its uranium ore production in the Edgemont, S. D., area to 4000 tons per month, according to Giant's president, T. R. Gillenwaters.

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## Van Stone Mine Closed

Operations at the Van Stone Mine of American Smelting & Refining Co. east of Colville, Washington's largest zinc producer and third-largest lead producer, were suspended on July 15 until lead-zinc prices improve.

Two other Asarco zinc mines, the Ground Hog at Vanadium, N. M., and the Keystone at Crested Butte, Colo., and the Deming, N. M., mill were also shut down.

The closings curtailed production of zinc about 3000 tons monthly and that of lead about 500 tons a month.


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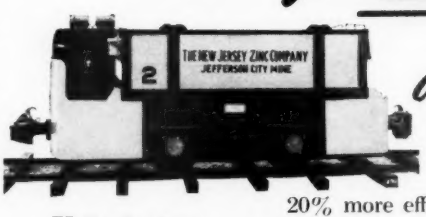
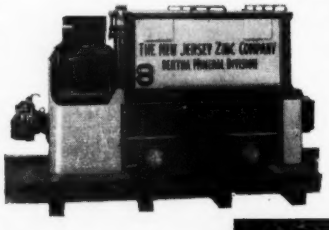



7T Monitor-type

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## Lucky Mc & Phelps Dodge Mill Proposal

Lucky Mc Uranium Corp. and Phelps Dodge Corp. have presented a joint proposal to the Atomic Energy Commission for an addition of 1000 tons a day to the capacity of the Lucky Mc mill in the Gas Hills uranium district, Fremont County, Wyo.

The proposal, if resolved in contract form, would bring to 700 tons daily the processing allocation for custom ore produced by non-mill-connected miners in the Crooks Gap and Gas Hills area.

The Lucky Mc mill, currently being erected, is a 750-ton per day mill. The latest modified proposal would ultimately bring the mill's capacity to 1750 tpd, making it one of the largest in the domestic uranium business.

It is reported that Phelps Dodge would receive a 30 percent share in the 1000 tpd expansion capacity but would not become a stockholder of Lucky Mc. Lucky Mc would gain 300 tpd capacity, while the remaining 400 tpd of capacity would be allocated to custom shippers.

Phelps Dodge has also exercised an option to acquire 51 percent interest in Wyoming Uranium Corp. The copper company plans to organize a subsidiary uranium corporation in which Wyoming Uranium stockholders will receive Class A stock entitling them to 75 percent of the first $1,000,000 of dividends and 49 percent of dividends thereafter.

Wyoming Uranium's properties are in Fremont County.

## Open Spokane Exploration Office

Hecla Mining Co., Wallace, Idaho, has opened exploration headquarters in Spokane, Wash. The Spokane staff consists of Herbert E. Harper, chief geologist, and James J. Quinlan, exploration geologist. Harper, who joined Hecla in 1946, was made chief geologist a year ago.

## Government to Buy Antimony

The General Services Administration has agreed to purchase nearly $1,000,000 of antimony metal from Sunshine Mining Co., Kellog, Idaho, for the national stockpile. The contract calls for delivery of 1500 tons of antimony metal over an 18-month period starting in July.

In order to produce the grade of metal required by the GSA, Sunshine has developed a process for refining the impure cathode antimony metal which it has been producing in its electrolytic antimony plant.

The antimony is produced as a by-product of making silver concentrate from tetrahedrite ores. Current production is more than 100,000 lb monthly. Sunshine is the only producer of antimony in the United States.




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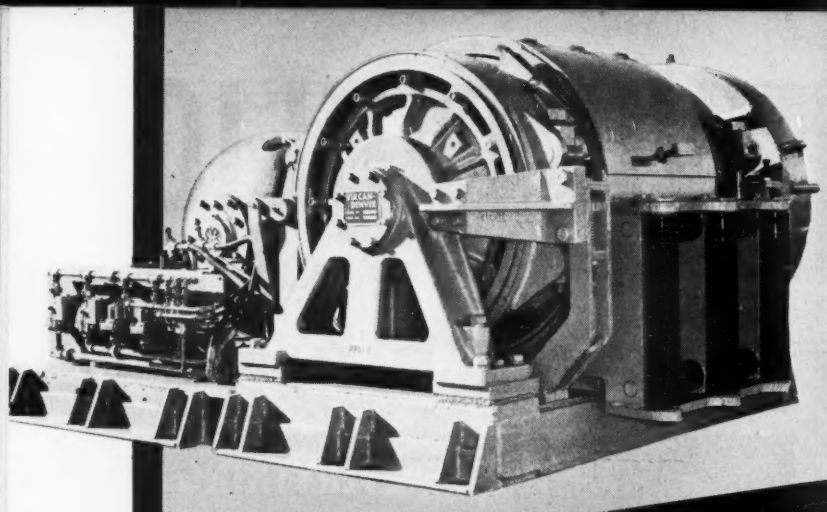

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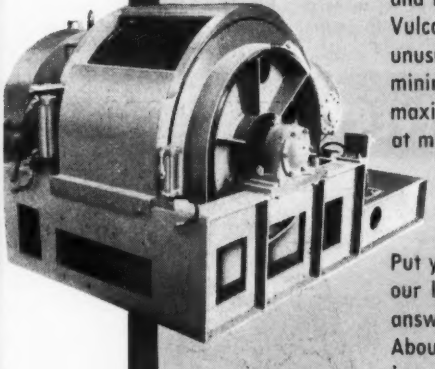

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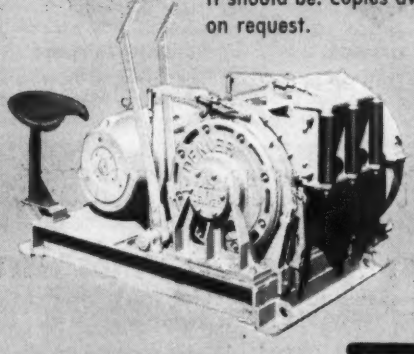

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## Second Symposium on Rock Mechanics

Theme of the recent Second Annual Symposium on Rock Mechanics was, "Behavior of Materials in the Earth's Crust." Held in April, the meeting was sponsored by the Colorado School of Mines, Golden, Colo.

Progress in sister fields of engineering was portrayed in the first session, while applications of structural geology and petrology to rock mechanics —and vice versa—were well brought out in the second session. The third session covered the field of stress and strain instrumentation underground, together with the interpretation of these measurements. In the fourth session, two timely but different solutions—rock bolting and cementation—of the same problem—roof and wall support—were presented. The final session pointed up the urgency and universality of rock mechanics problems in the mineral industries today.

Of interest to the followers of rock mechanics will be the announcement that future Symposia will be held under the joint sponsorship of the departments of mining engineering at three institutions of higher learning: The University of Minnesota, Pennsylvania State University, and Colorado School of Mines. At present, these schools sponsor three Symposia, which in addition to rock mechanics include drilling and blasting and exploration drilling. It is now planned that all three symposia will rotate among the three schools and that each symposium will be held every other year.

## Wyoming Phosphate Plant

San Francisco Chemical Co., Montpelier, Idaho, believes its wet concentration process for phosphate ores will enable it to market phosphates from low-grade western ores in competition with higher-yield eastern phosphates.

Latest addition to the firm's separation equipment is the "C" plant, placed in operation recently at nearby Leefe, Wyo. Finely ground ore is mixed with liquid chemicals in the new separation process. The plant is the result of more than two years of intensive research at the Colorado School of Mines Research Foundation at Golden.

Improvements in San Francisco Chemical's ore roasting separation process will be incorporated in another conversion plant currently planned by the company.

The company now has a purely mechanical separation process for its best ores, which it can combine as needed with the B plant roasting or fluo-solids facilities, or the C plant wet process to free phosphates from lower-grade ores.

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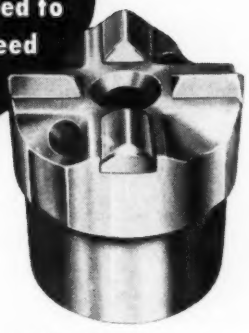

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### C & H to Build Uranium Plant

Calumet & Hecla, Inc., Chicago, has awarded a contract to an Albuquerque, N. M., company for erection of a surface plant for a new uranium mine near Grants, N. M.

Mining of the 500,000-ton ore body will be through an inclined haulageway, with full production scheduled early in 1958. The initial ore body to be developed represents exploration results to date on a small portion of the land under C & H control at the New Mexico location. Continued drilling is increasing company reserves in the area as well as extending limits of the present ore body.

Although the surface plant will have a capacity of 500 tpd, actual volume at the outset will be governed by the capacity of nearby mills to treat the ore.

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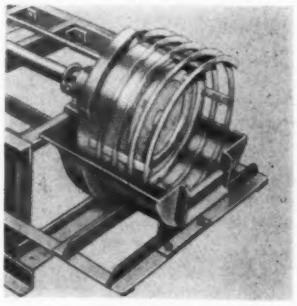

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### Oregon Lime-Burning Plant

Construction is well advanced on the lime-burning plant being erected at Wingville, Ore., by the Chemical Lime Co. of Baker County. Primary crusher installations have been completed at the quarry in Marble Mountain, and stockpiling of rock at the plant is scheduled to start soon. Burning facilities now being installed are expected to turn out about 200 tons of burned-lime products a day.

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### New Potash Mine Started

International Minerals & Chemical Corp. has begun a shaft for a new potash mine in the Canadian province of Saskatchewan. The site is on 450,000 acres which IMC controls under permits near Esterhazy, about 150 miles east of the provincial capital of Regina.

The company announced that the ore has been thoroughly drilled and has proved of higher grade than that in the company's Carlsbad, N. M., mine, which in recent years has supplied about 20 percent of the potash products used in the United States.

The company's Canadian area is believed to contain ample reserves for a mine that will produce at more than twice the rate of the Carlsbad mine.

The contract for construction of the mine shaft and several surface structures has been let and work will be rushed to complete the buildings before the end of the short summer period. Merton I. Signer, IMC's resident manager, will supervise the construction.

### Dakota Collieries Sold

After 35 years of continuous operation in the lignite fields of North Dakota, Twin Star Industries, Inc., has sold its Dakota Collieries Lignite Division to North American Coal Co. of Cleveland, Ohio.

Twin Star Industries is presently emphasizing the development of lignite and the operation of nonmetallic mineral properties in Texas and the Southwest.

### Copper Work Schedule Cut

The Anaconda Co. has put operation of its Weed Heights, Nev., mine on a five-day week basis instead of six. There will be no reduction in the working force of about 575.

The company said the shorter work week, which will cut Nevada mine production about 17 percent, was made necessary by the decline in copper prices and other economic factors.

### Mercury Furnace Installed

The Bretz mercury mine near McDermitt, in southeastern Oregon, reopened last December by Arentz-Comstock Mining Venture, has installed a 10-ton Herreschoff furnace. The furnace will replace the previously used D-retorts which proved inadequate to handle concentrates from the 150-ton flotation plant. Open-pit mining of the new ore body was begun early in May.

The management has planned an extensive exploration program for the summer.

### American Metal Obtains Option

The American Metal Co. bid for an option agreement to obtain a 60 percent interest in Montgary Explorations, Ltd., lithium mine at Bernic Lake, Manitoba, was approved by Montgary stockholders recently.

The option gives American Metal the right to examine the lithium ore body and the option to participate in the development of the mine, flotation concentrator and marketing of spodumene concentrates.

### Payday Resumes Operation

The Payday Mine of Shumway Uranium Co., one of the major uranium producers on Elk Ridge near Blanding, Utah, has resumed shipments to the Monticello mill after being closed for several months. Last year the mine shipped about 1500 tons of ore per month.

### Golconda Mills Morning Output

Lead-zinc ore from the Morning Mine at Mullan, Idaho, is now being concentrated in the Golconda custom mill near there. Morning mill was leveled by fire on May 21.

Production at the Morning Mine is only half of that before the fire. The output of a little more than 100 tpd is coming from mine development headings, mostly from the Noonday vein.

### Alumina Plant Progresses

Within less than a year ore boats will begin unloading to supply the huge alumina plant now under construction at Point Comfort, Tex., for the Aluminum Company of America.

Boats from Cabo Rojo, Dominican Republic, and Port of Spain, Trinidad, will tie up at the Aransas County Navigation District's port at Harbor Island. The port, also still under construction, is designed for transshipment of the ore from ocean-going carriers to barges for final delivery to the Point Comfort plant.

A dredge will make a deep-water channel from the Port Aransas-Corpus Christi waterway to the docks at which Alcoa will unload. Dredging will be completed about the last of November and pile drivers will move in to start the unloading facilities.

Twelve barges will be used for the final trip from Harbor Island to Point Comfort. The round trip for barges will require about 40 hours.

About 60,000 tons of bauxite a month will be brought in, to be increased later to 140,000 to 150,000 tons a month.

It is estimated that it will be at least four years before additional waterways work will allow the ore ships to tie up at Point Comfort for direct unloading at the plant.

### Wins Safety Award

Kennecott Copper Corporation's Chino Mines Division, Hurley, N. M., has won the National Safety Council's highest recognition, the award of honor, for the second straight year. The award was presented by Gov. Edwin L. Mechem to J. K. Richardson, assistant general manager.

Chino's accident severity rate was 97 percent better than the national average; its accident frequency rate was 68 percent better.

### Eagle-Picher Resumes

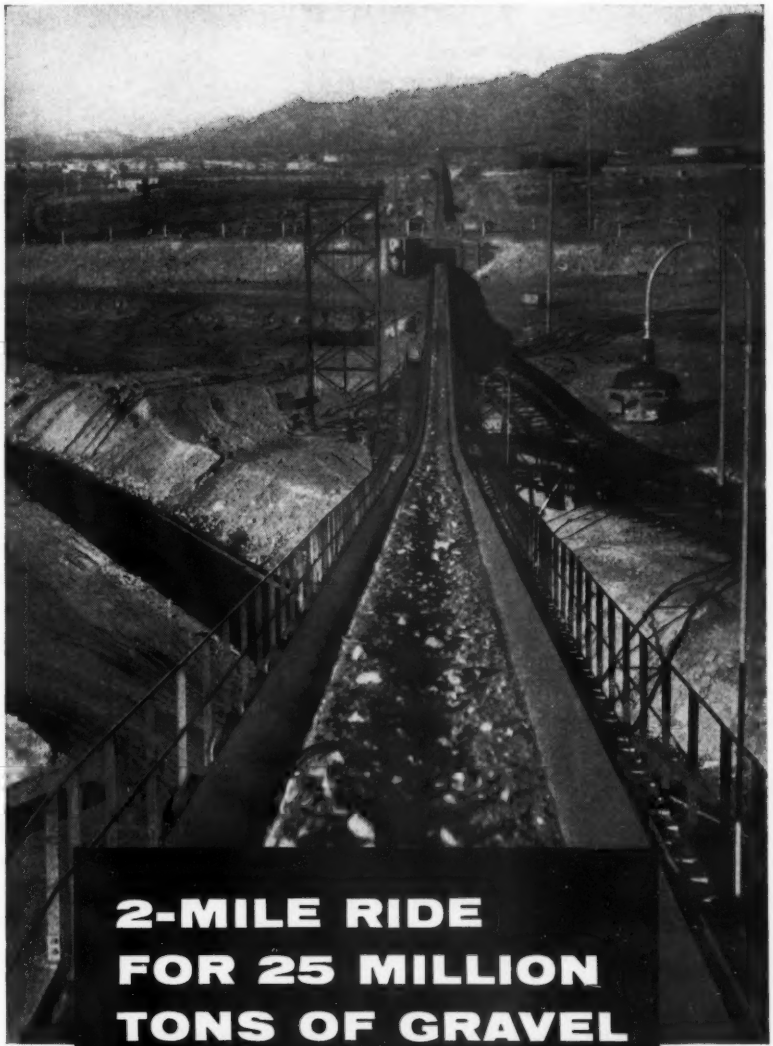
The Eagle-Picher Co. resumed mining and milling operations in the Tri-State field of Oklahoma, Missouri and Kansas after a suspension of operations which started April 29.

Approximately 500 persons returned to their jobs with Eagle-Picher, and an estimated 400 others also resumed employment with other companies. Eagle-Picher processes lead and zinc ores for many of the smaller companies in the area.

### Leases 40 California Uranium Claims

National Tungsten Corp. of Los Angeles, has leased 40 uranium claims in the Jackass Mining District of Madera County, Calif. Open-pit mining equipment is being shifted to the site, near Fresno, from National Tungsten's mill near Porterville, Calif.






To help build Southern Pacific Railroad's 13-mile roadbed across Great Salt Lake, Morrison-Knudsen Co. had Hewitt-Robins develop a bulk materials handling system. In ton-miles-per-hour capacity, this system surpasses any previous belt conveyor installation. Its conveyors travel at speeds up to 850 fpm, carry 75,000 tons of rock and gravel per day, load barges at 12,000 tons per hour.

The entire installation—including 3 scalpers, 13 conveyors, 23,000 feet of belting, 4,700 idlers, a 164-ft. radial stacker, 10 belt feeders, 2 recovery conveyors and 27 speed reduction drives—was designed, manufactured and delivered by Hewitt-Robins in less than eight months. To find out how H-R products and services can help you, consult your classified telephone directory for the nearest H-R representative, or contact Hewitt-Robins, Stamford, Conn.

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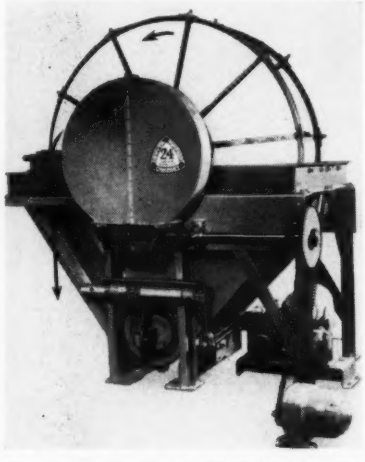
# Manufacturers Forum

## Disc Filter

AN "AGITATOR TYPE" Disc Filter has been announced by Denver Equipment Co., P. O. Box 5268, Den-



ver 17, Colo. Pulp agitation is supplied by a pulsating unit located below filter discs. Design and location of agitation mechanism are said to provide correct type agitation to keep solids in pulp in suspension; agitation speed is adjustable to maintain a homogeneous pulp.

The agitator mechanism is removable for service as a unit. Packing gland, sealing water, and bearings in the tank have been eliminated.

## Core Storage

A LINE OF SAMPLE AND CORE RACKS and trays have been introduced by Tomco Products, 5426 Schuhmacher Lane, Houston 27, Tex. The Tomco trays are made of galvanized sheet steel or sheet aluminum; racks are of steel angle and can be furnished either painted or galvanized.

Standard trays are available for four sizes of core—1, 1⅛, 1⅝ and 2¼ in. They are made in two lengths, 3 ft 0 in. and 6 ft 0 in., and are approximately 18 in. wide. Troughs of the trays are formed for the core and are deep enough so that one tray can be stacked on top another when loaded. The trays slide into the racks themselves in the same manner as a set of drawers.

The rack is made of angles and these are so arranged that one rack can be attached to another with a couple of bolts so that they can all be hooked together. They may also be attached back to back. The tray slides are also adjustable and therefore different size core trays can be used in the same rack.

## Six-Wheel Truck

THIS V-8 POWERED UNIT, the model VF-230, has been introduced by the motor truck division of International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill. It is powered by the International truck-type V-549 engine rated at 275 hp, and has a gross vehicle weight rating of 60,000 lb. Company officials claim that the VF-230 truck has been designed and built to meet the requirements of severe off-highway operation and to absorb the shock of loading by large shovels and draglines.

Standard equipment includes a 15,000-lb front axle, 46,000-lb rear bogie, hydraulic full-power steering, air brakes, 12-volt electrical system, 15-in. clutch, 60-gal right-side step fuel tank and heavy 2⅜-in. steel grille guard. Standard wheelbase is 175 in.

**Inquiries about new equipment appearing in Manufacturers Forum are welcomed. For additional information on any piece of equipment in this section write directly to the manufacturer, or to Mining Congress Journal with name of item and date of issue in which it appeared.**

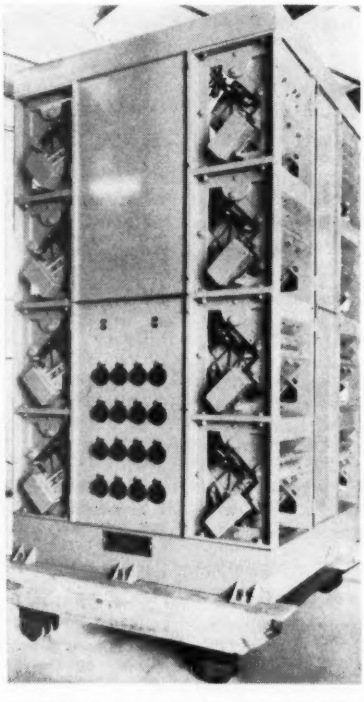
## For Heating and Cooling

AN AIR DUCT CONSTRUCTION for heating and cooling as conveyor belt passes through has been developed by the Dean Thermo-Panel Coil Division of Dean Products, Inc., 616 Franklin Ave., Brooklyn 38, N. Y. Made up principally of standard thermo-panels, the Dean Thermo-Panel Coil consists of two sheets of specified metal, welded together. Before welding, one or both of the sheets are embossed. These embossings create flow channels for the steam, hot water, or other medium used for doing the heating or drying.

## Largest High Intensity Magnetic Separator

COMPLETION of one of the world's largest high intensity magnetic separators has been announced by Carpco Manufacturing, Inc., Jacksonville, Fla. At maximum flux, these separators create 176,000 magnetic lines of force per sq in., giving a total of 57,600,000 lines of force available for separation in a 16-rotor machine.

According to Carpco's president, J. Hall Carpenter, the new high intensity induced roll magnetic separator represents one of the highest intensity units ever produced. Feed rates from 8000 to 32,000 lb per hour can be handled by the 16-rotor machine.



The machines have unitized design, each rotor unit comprising a complete magnetic separator in itself. The machines reportedly may be set up to give any combination of flow of material such as repassing either magnetic or non-magnetic products. The flux intensity of every rotor may be individually adjusted electrically.

## Tractor—Remote Controlled

A "ROBOT" TRACTOR that can be operated anywhere within range of the radio by which it is controlled is undergoing tests at the U. S. Army Research and Development Laboratories, Fort Belvoir, Va., the Department of the Army has announced.

From a jeep or helicopter equipped with a standard military radio transmitter and a special control box, the operator can start and stop the machine, engage and disengage the gears, operate in forward and reverse, manipulate the dozer blade up and down, and activate the steering mechanism.

Normal operations can be performed from distances of up to 15 miles, the practical range of the radio, simply by manipulating the buttons on the control box. Army engineers believe that the installation of small television cameras on the tractor will give the remote operator additional knowledge and observation of the machine, and give him the ability to work it without the need of information relayed by a visional observer.

The prototype is the standard commercial "tournadozer" manufactured by Le Tourneau-Westinghouse Co. of Peoria, Ill. The only visible change to the machine is the substitution of a standard military radio receiving set for the operator's seat.

## — *Announcements* —

**Anaconda Wire & Cable Co.** announced recently plans for the construction of a wire and cable manufacturing plant in Watkinsville, Ga. Construction of the facilities will begin as soon as land purchases have been completed.

The plan calls for a building of some 150,000 sq ft which will house equipment for the production of various types of copper and aluminum wires and cables. A warehouse area will also be provided.

**A. L. Dassler** has been promoted from assistant chief engineer to chief engineer of **Koehring Div.**, Milwaukee. He will supervise design of Koehring's complete line of shovels, hoes, draglines and cranes.

**P. N. Miles** has been named manager of the **Mining Sales Division of Christensen Diamond Products Co.** He succeeds **Alan Conner** who is currently directing operations at Castle Concrete Co., a subsidiary of Christensen.

**G. H. Olson**, a vice-president and a director of **Link-Belt Speeder Corp.**, subsidiary of **Link-Belt Co.**, retired July 1 after 47 years of service.

**The Mine, Mill & Smelter Co.**, and its subsidiary **Colorado Iron Works Co.**, have completed a $1,000,000 expansion program including a new office building and additional shop facilities in Denver. Address of the new office is 3800 Race, Denver, Colo.

**O. J. Ellertson**, president of Pioneer Engineering, a Division of Poor & Co., has been elected vice-president of the parent company in Chicago.

Announcement is made of the appointment of **Herbert M. Weed** to the position of assistant to the executive vice-president, **Anaconda Sales Co.** Weed has been assistant to the vice-president, Chile Exploration Co. since 1956.

**Donald M. McDowell** has been named manager of engineering for the **Le Roi Division, Westinghouse Air Brake Co.**

## CATALOGS & BULLETINS

TRACTOR. *Construction Equipment Division, International Harvester Co., 180 N. Michigan Ave., Chicago, Ill.* "Strength, performance, and handling ease unmatched in the Utility tractor field," is the way the International 350 Utility tractor is described in this eight-page mailer. Booklet CR-1333-G points out that the wheel-type unit can be obtained with carbureted (gasoline or LPG) or diesel engine and can be used with 75 attachments on countless applications.

AUGER DRILL PARTS. *The Salem Tool Co., Salem, Ohio.* Parts Bulletin No. 11156 lists drilling augers, heads, bits and other accessory parts for the firm's line of McCarthy coal recovery, horizontal and vertical auger drills. Various size attachments equip the McCarthy drills to bore holes from 3 to 48 in.

COAL HANDLING. *Construction Equipment Division, International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill.* Entitled "The Money-Saving Way to Stock-Out, Reclaim and Compact Coal," Booklet CR-618-G portrays in detail the proper way to prepare an area to support a stockpile and the procedure to follow for profitable and safe stockpiling. An equipment "select-o-graph" helps match units to the haul requirements in stockpiling and reclaiming. Appropriate units for short, medium and long hauls are suggested.

*(Continued on next page)*

*(Continued from page 115)*

CRAWLER TRACTOR. *Allis-Chalmers Manufacturing Co., Construction Machinery Division, Milwaukee, Wis.* A cutaway view of the Allis-Chalmers HD-21 diesel powered torque converter drive crawler tractor highlights specification sheet MS-1191. Marginal notes along side the cutaway view point to many of the HD-21's mechanical, design and construction features.

A QUARTER CENTURY OF DIESEL LEADERSHIP. *Caterpillar Tractor Co., Peoria, Ill.* Form No. D703 tells the story of Caterpillar's many engineering achievements since the company's entrance into the diesel engine field in 1931.

PUMPS FOR DIAMOND DRILLING. *E. J. Longyear Co., Minneapolis 2, Minn.* Co-authored by A. F. Pickard and Ray L. Luelf, this publication deals with transmission and single speed pumping units used in the diamond drilling industry. The material explains drilling practices and outlines the advantages of transmission pumps for most core drilling operations.

BELT REBUILDING SERVICE. *Conveyor Belt Service, Inc., 705 Sixth Ave. North, Virginia, Minn.* Entitled "Conveyor Belt Service, Inc.," the booklet describes the company's nation-wide belt rebuilding service. The firm is said to specialize in the repair, overhaul and rehabilitation of all types of worm and damaged conveyor and transmission belting—and in addition maintain complete facilities and personnel to handle ordinary repairs and splicing of every nature in the field and customer's plant.

TELESCOPIC HOISTS. *Galion Allsteel Body Co., Galion, Ohio.* Catalog LL-4094 covers the complete Galion Allsteel line of telescopic hoists, describing various Uni-scopic single front mounted and Duoscopic twin front mounted telescopic hoists. Descriptions and specifications cover nine hoist models, with payload capacities from 9 to 34 tons.

COTTRELL AUTOMATION SYSTEM. *Research-Cottrell, Inc., Bound Brook, N. J.* Bulletin describes the Cottrell automation system which is said to bring complete automation to the power inputs of electrostatic precipitators, eliminating manual adjustments and increasing round-the-clock dust and fume collection efficiencies.

LIFT TRUCKS. *Yale Materials Handling Division, Yale & Towne Manufacturing Co., 11000 Roosevelt Blvd., Philadelphia 15, Pa.* This 16-page brochure describes the G-3 Series of 15,000 to 20,000 lb capacity industrial lift trucks with "Wide Angle Vision." Various design components are pictorially presented and a "phantom view" of the truck permits the study of internal working features.

WIRE ROPE RECOMMENDATIONS. *Hazard Wire Rope Division, American Chain & Cable Co., Inc., Wilkes-Barre, Pa.* Bulletin DH-129-B describes Hazard's complete line of Lay Set Preformed Wire Rope, Wire Rope Accessories and Dualoc Boom Cable Assemblies. It contains data on construction features, applications and diameters. Revised and brought up-to-date, the bulletin covers all types of wire rope used in construction by angle dozers, back hoes, back fillers, bulldozers; in cable ways, concrete mixers, concrete powers, hoists, cranes, derricks; in ditchers, draglines, drag scrapers, drilling machines; in pile drivers, scrapers, shovels, skimmers; in slings, slackline excavators, trench hoes, wagons, winch trucks; as sway braces, back stays and boom extenders.

SELF-PROPELLED SCRAPER. *Construction Equipment Division, International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill.* Latest engineering developments on the Model 55 Payscraper are described in Booklet CR-525-G. The illustrated pamphlet emphasizes bigger payload and better design advantages of the 14 cu yd self-propelled scraper. One page is devoted to brief specifications of the various components of the unit.

PULVERIZER. *Foster Wheeler Corp., 165 Broadway, New York 6, N. Y.* This descriptive brochure covers the Type MB planetary roll and table pulverizers, developed in Germany. The pulverizer is being made in ten models with nominal capacities of from 2 to 40 tons per hour, and is said to offer unusual advantages in economy of operation and maintenance and in uniformity of product fitness.

GEARMOTORS AND PACKAGE DRIVES. *Westinghouse Electric Corp., P. O. Box 2099, Pittsburgh 30, Pa.* Booklet DB-3650 illustrates horizontal, vertical, right angle, open, enclosed, explosion-proof, a-c and d-c units with their respective reduction ratios and output speeds. The Westinghouse gearmotors are designed in accordance with AGMA classes I, II, III and range in speed from 7.5 to 780 rpm.

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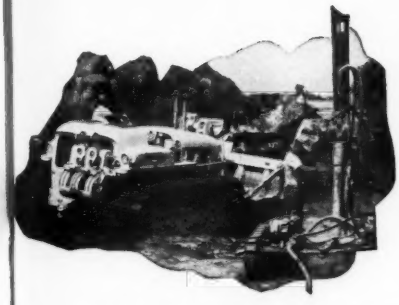
# Here's why Euclid TC-12 Twin-Power Crawlers give you MORE WORK-ABILITY



**With 436 hp, independent track drive and many other advanced design features, the TC-12 has set completely new standards of performance for big tractor work.**

**Your Euclid Dealer will be glad to provide specifications and performance data on work similar to yours.**

**SPEED**

The TC-12 has speed—up to 7.8 mph forward or reverse—but that's not all. Pivot turns (one track forward and one reverse at the same time) plus changing of direction and range under full power without loss of momentum save considerable time during the tractor's daily operation.

**POWER**

Two engines with a total of 436 h.p. (413 net h.p. at drive train) make this Euclid "Twin" the world's most powerful crawler. Being more powerful, the TC-12 offers additional benefits, such as faster work and longer engine life, since the engine often operates at less than full capacity without strain. And, the reserve power permits handling the toughest tractor job.

**MANEUVERABILITY**

Pivot turns with the TC-12 take less space and time. Changing directions on the go with Torqmatic Drives makes maneuvering into position quicker. Split-half construction gives better traction on uneven ground.

**EASY OPERATION**

Clutching and shifting are eliminated with the TC-12 "Twin". There's 24-volt push-button starting and instant response to directional levers, range selector and hand throttle levers, all of which are conveniently located to allow complete freedom of the operator's right hand for control of attachments.

**DESIGNED FOR EASY SERVICING**

Many design features contribute to long life and easy servicing. Location of radiator behind operator reduces damage and improves cooling. Track tensioning and recoil system are automatic. All engine accessories are readily accessible from outside the engine compartment. Rollers can be removed without breaking track. Engines, Torqmatic Drives, and planetary final drives can be removed without disturbing the other components.

**THEY ALL ADD UP to just one thing—**
**Euclids are your best investment.**

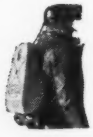
**EUCLID DIVISION,**
**GENERAL MOTORS CORPORATION, Cleveland, 17, Ohio**

# Euclid Equipment

FOR MOVING EARTH, ROCK, COAL AND ORE

# "IN CASE OF EMERGENCY"

Mine emergencies happen without warning . . . and when they do happen, equipment that carries the "in case of emergency" label suddenly becomes vital to fire fighting and rescue efforts. Breathing protection devices are a major part of emergency mine equipment.



**M-S-A McCAA® Oxygen Breathing Apparatus—**
gives complete breathing protection in any unbreathable atmosphere for a minimum of two hours. Used under the hardest physical conditions . . . in fighting and sealing fires, re-establishing ventilation, and rescue operations. U. S. Bureau of Mines approved.

**M-S-A Chemox®—**
allows complete breathing protection in any gaseous or oxygen deficient area for a minimum of 45 minutes. Generates its own oxygen supply from replaceable canister. Weighs only 13½ lbs. U. S. Bureau of Mines approved.

**M-S-A All-Service Mask®—**
assures safe, comfortable breathing protection against smoke and toxic gases including carbon monoxide—singly—or in combination where there is sufficient oxygen to sustain life. U. S. Bureau of Mines approved.

Below is a check list of this equipment offered by MSA. If you would like to make sure your emergency program is up-to-date, why not have our representative check your requirements and suggest a regular inspection and maintenance schedule.

**M-S-A Self-Rescuer®—**
a miniature mask for use in deadly carbon monoxide following fire or explosion. Gives the miner precious minutes of emergency breathing protection. Unit is compact, lightweight; may be stored in quantity underground or carried individually. U. S. Bureau of Mines approved.

**M-S-A Air and $O_2$ Mask—**
designed for 30 minutes maximum breathing protection in any atmosphere—supplies air or oxygen in exact accordance with breathing requirements. Flow ceases during exhalation for added economy. Comfortable to wear and easy to use.

**M-S-A Pneolator®—**
provides automatic artificial respiration that assures maximum chances of recovery for victims of poisonous gases, electrical shock, heart attacks, or other causes of asphyxia. Housed in compact, lightweight glass fiber case.

MSA
SAFETY EQUIPMENT HEADQUARTERS

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*At Your Service: 77 Branch Offices in the United States and Mexico*

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